

**CIRCULATING ISSUE**

FORTY-SEVENTH ANNUAL MEETING, PALMER HOUSE, CHICAGO  
NOVEMBER 26-DECEMBER 1, 1961

Med.

# RADIOLOGY

A MONTHLY JOURNAL DEVOTED  
TO CLINICAL RADIOLOGY AND  
ALLIED SCIENCES



DARTMOUTH COLLEGE

JUN 27 1961  
LIBRARY

JUNE · 1961

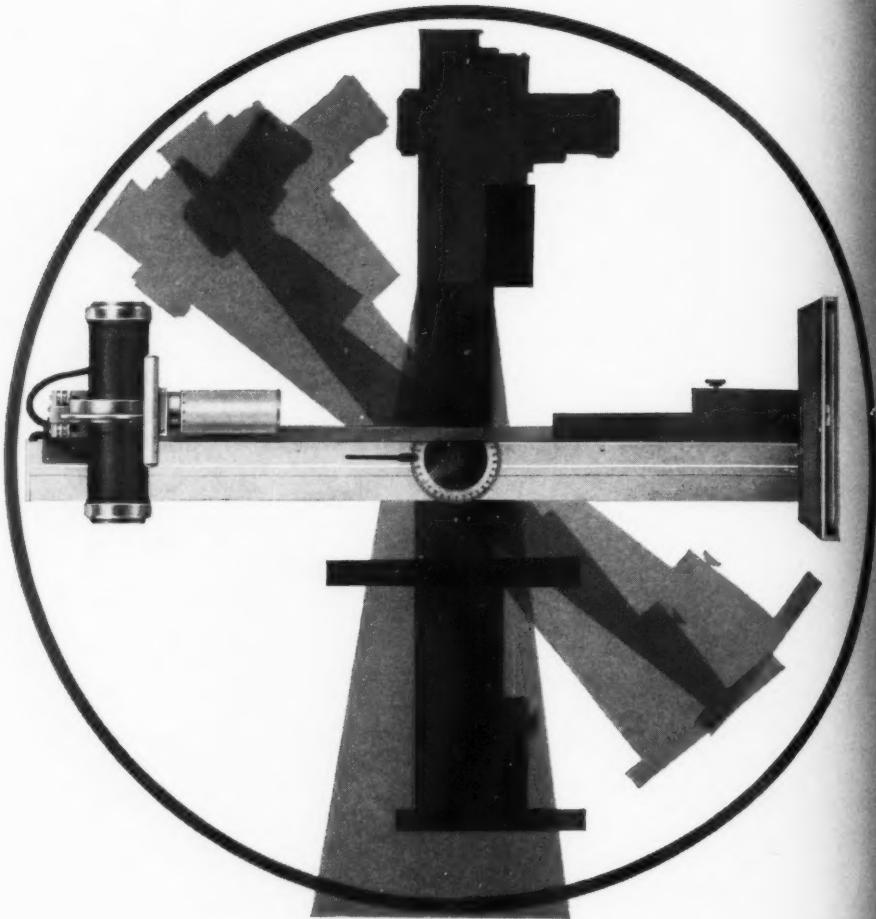
VOLUME 76

NUMBER 6

---

---

*Owned and Published as its Official Journal by*  
**THE RADILOGICAL SOCIETY OF NORTH AMERICA**



The Chesapeake increases patient flow with minimum investment. This new, all-purpose radiographic unit has been designed by Westinghouse . . . to be compact . . . to handle all radiography and most special techniques . . . to free expensive equipment. For more information: Westinghouse Electric Corporation, X-Ray Department, 2519 Wilkens Ave., Baltimore 3, Md. You can be sure . . . if it's



stment.  
West-  
d most  
e infor-  
rtment,  
. if it's

house

J-00002

S

Vol.

June

# RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

Vol. 76

JUNE 1961

No. 6

## CONTENTS

THE MEASUREMENT OF RADIANT ENERGY LEVELS IN DIAGNOSTIC ROENTGENOLOGY. <i>Russell H. Morgan, M.D.</i>	867
GONADAL EXPOSURE INCIDENT TO ROENTGEN THERAPY. <i>Gustave Kaplan, B.S., M.D., Carl Collica, B.S., and Sidney Rubenfeld, M.D.</i>	877
GONADAL DOSAGE IN PEDIATRIC RADIOTHERAPY. <i>John L. Gwinn, M.D., David C. Gastineau, M.D., and John A. Campbell, M.D.</i>	881
PULMONARY VEINS IN CONGENITAL HEART DISEASE IN THE ADULT. <i>Robert S. Ormond, M.D., Andrew K. Poznanski, M.D., and Arch W. Templeton, M.D.</i>	885
TOTAL ANOMALOUS PULMONARY VENOUS DRAINAGE INTO THE PORTAL SYSTEM. <i>Bertram Levin, M.D., and Harvey White, M.D.</i>	894
RADIOLOGIC LOCALIZATION OF THE ESOPHAGEAL HIATUS AS DETERMINED BY INTRALUMINAL PRESSURE MEASUREMENTS. <i>Bernard S. Wolf, M.D., and Bernard R. Cohen, M.D.</i>	903
MEDULLARY SPONGE KIDNEY. <i>A. J. Palubinskas, M.D.</i>	911
MEDULLARY SPONGE KIDNEY. ROENTGEN DIAGNOSIS OF THREE CASES. <i>P. G. Secrest, M.D., and Tom A. Kendig, M.D.</i>	920
RESULTS OF X-RAY TREATMENT IN UNDIFFERENTIATED CARCINOMA OF THE THYROID. <i>Magnus I. Smedal, M.D., and William A. Meissner, M.D.</i>	927
LOCALIZING THE PLACENTA WITH RADIOACTIVE IODINATED HUMAN SERUM ALBUMIN. <i>Fred C. Heagy, M.D., and Donald P. Swartz, M.D.</i>	936
OBSERVATIONS ON THE ANTITUMOR EFFECT OF N-DICHLOROACETYL-DL-SERINE (FT-9045). <i>H. Blondal, M.D., I. Levi, Ph.D., J. P. A. Latour, M.D., and W. D. Fraser, M.D.</i>	945
THE PRONE POSITION IN INTRAVENOUS UROGRAPHY FOR STUDY OF THE UPPER URINARY TRACT. <i>Milton Elkin, M.D.</i>	961
USE OF "RADIOPAQUE STREAMERS" TO SHOW BLOOD CURRENTS IN THE HEART. <i>T. Doby, M.D.</i>	968
EDITORIAL: THE HAZARDS OF MEDICAL IRRADIATION. <i>Robert J. Bloor, M.D.</i>	970
GRADUATE PROGRAMS IN THE RADIOLOGICAL BASIC SCIENCES. <i>Frederick J. Bonte, M.D.</i>	973
IN MEMORIAM: DAVID M. GOULD, M.D.	976
ANNOUNCEMENTS AND BOOK REVIEWS.	978
ABSTRACTS OF CURRENT LITERATURE.	981
INDEX TO VOLUME 76.	1000

# RADIOLOGY

A MONTHLY PUBLICATION DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES  
PUBLISHED BY THE RADILOGICAL SOCIETY OF NORTH AMERICA, INC.

#### ASSOCIATE EDITORS

Leo G. Rigler, M.D.  
Laurence L. Robbins, M.D.  
Harold W. Jacox, M.D.  
William R. Eyler, M.D.

#### PUBLICATION COMMITTEE

John A. Evans, M.D., Chairman  
William T. Moss, M.D.  
John L. McClenahan, M.D.

#### EDITOR

HOWARD P. DOUB, M.D.  
Henry Ford Hospital, Detroit 2, Mich.

#### EDITORIAL ASSISTANTS

Marion B. Crowell, A.B.  
Florence Roper Jeffery, A.B.  
Arlene W. Hippie, A.B.

#### ADVISORY EDITORIAL BOARD

Richard H. Chamberlain, M.D.  
Edith H. Quimby, Sc.D.  
Arthur Purdy Stout, M.D.  
Donald S. Childs, Jr., M.D.  
Robert P. Berden, M.D.

## GENERAL INFORMATION

Second-class mail privileges authorized at Syracuse, New York with additional entry at Easton, Pennsylvania. Acceptance for mailing at a special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized November 24, 1934. RADIOLOGY is published by the Radiological Society of North America as its official Journal. Publication office, 20th and Northampton Streets, Easton, Pa. Subscription rate \$15.00 per annum. Canadian postage, \$1.00 additional. Foreign postage, \$2.50 additional. Single copies \$2.50 each. All correspondence relative to business matters connected with the Radiological Society of North America and RADIOLOGY, or remittance for non-member subscriptions, should be made payable to The Radiological Society of North America, Inc., and should be addressed to the BUSINESS MANAGER, RADIOLOGY, 713 E. GENESEE STREET, SYRACUSE 2, NEW YORK. In requesting change of address, both the old and the new address should be given.

Dues to The Radiological Society of North America include subscription to RADIOLOGY and should be paid to Dwight V. Needham, M.D., TREASURER of The Radiological Society of North America, Inc., 713 E. GENESEE STREET, SYRACUSE 2, NEW YORK.

Inquiries regarding the program for the Annual Meeting of the Society for the current year should be sent to the President.

RADIOLOGY is published under the supervision of the Publication Committee of the Radiological Society of North America, which reserves the right to reject any material submitted for publication, including advertisements. No responsibility is accepted by the Committee or the Editor for the opinions expressed by the contributors, but the right is reserved to introduce such changes as may be necessary to make the contributions

conform to the editorial standards of RADIOLOGY. Correspondence relating to publication of papers should be addressed to the EDITOR, HOWARD P. DOUB, M.D., HENRY FORD HOSPITAL, DETROIT 2, MICHIGAN.

Original articles will be accepted only with the understanding that they are contributed solely to RADIOLOGY. Articles in foreign languages will be translated if they are acceptable. Manuscripts should be typewritten double-spaced, with wide margins, on good paper, and the original, not a carbon copy, should be submitted. The author's full address should appear on the manuscript. It is advisable that a copy be retained for reference as manuscripts will not be returned.

Illustrations and tables should be kept within reasonable bounds, as the number which can be published without cost to the author is strictly limited. For excess figures and for illustrations in color, estimates will be furnished by the Editor. Photographic prints should be clear and distinct and on glossy paper. Drawings and charts should be in India ink on white or on blue-lined coordinate paper. Blueprints will not reproduce satisfactorily. All photographs and drawings should be numbered, the top should be indicated, and each should be accompanied by a legend with a corresponding number. Authors are requested to indicate on prints made from photomicrographs the different types of cells to which attention is directed, by drawing lines in India ink and writing in the margin. The lines will be reproduced, and the words will be set in type. Attention should be called to points which should be brought out in completed illustrations, by tracings and suitable texts. These instructions should be concise and clear.

As a convenience to contributors to RADIOLOGY who are unable to supply prints for their manuscripts, the Editor can arrange for intermediate prints from roentgenograms.

Contents of RADIOLOGY copyrighted 1961 by The Radiological Society of North America, Inc.

# RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES  
PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

Vol. 76

JUNE 1961

No. 6

## The Measurement of Radiant Energy Levels in Diagnostic Roentgenology<sup>1</sup>

RUSSELL H. MORGAN, M.D.

IN RECENT years, the biological effects of repeated small doses of ionizing radiation have been the subject of considerable study. Scientific investigation has shown that when certain critical organs are irradiated, changes may occur which impair organ function and alter organ morphology. Irradiation of the reproductive system, for example, may cause mutations in succeeding generations, and irradiation of the hematopoietic system may lead, after the lapse of a few years, to leukemia. Similar qualitative relationships exist between radiant exposure of the thyroid gland and thyroid cancer, between irradiation of the orbit and cataract, and between irradiation of bone and bone sarcoma. In addition to the foregoing, it is known that the life span of an organism may be reduced by radiation exposure. The precise mechanism of this effect, however, is poorly understood.

Although much has been written about the biological effects of radiation, it is noteworthy that current knowledge is more qualitative than quantitative. The reasons for this are not difficult to find. The investigation of dose-effects relationships in man is extremely difficult. For small doses of radiation, many years must elapse between the time of irradiation and the time when the effects are first detectable. Also, the effects induced by radia-

tion may be indistinguishable from those due to spontaneous causes; the leukemia produced by radiation, for example, has the same characteristics as the leukemia which develops spontaneously. Finally, since the radiation effects are generally deleterious, one is not free to study them by well controlled human experimentation.

The difficulties for the quantitative determination of dose-effects relationships in man may not, however, be insurmountable. Together, they constitute the type of problem which often may be effectively solved by the technics of epidemiology. Through epidemiological investigation it is frequently possible to gain considerable understanding, both quantitative and qualitative, of the effects of a particular toxic agent if a sufficiently large number of individuals, subjected during their normal lives to known doses of that agent, exhibit well defined biological changes. In the application of epidemiological methods to the field of radiation it is necessary that a substantial population be exposed to known quantities of radiation and that the members of that population be followed for a sufficient period to detect any biological changes which may occur. Since, as pointed out above, the biological changes due to radiation are similar to those arising spontaneously, it is necessary to study a comparable population which is not ex-

<sup>1</sup> Presented at the Forty-sixth Annual Meeting of the Radiological Society of North America, Cincinnati, Ohio, Dec. 4-9, 1960.

posed. Furthermore, for each biological effect under study, one must know not only the radiant exposure levels prevailing about each individual but also, since a given effect is often the result of the exposure of a particular critical organ, the dose received by that organ.

At the present time, there is a large population within the United States which is exposed to repeated small doses of radiation and therefore might be suitable for extensive epidemiological research, namely, those persons receiving x-ray exposure in the course of their medical care. Unfortunately, it has not been customary in the past to measure the quantity of radiant energy delivered to patients during diagnostic x-ray practice. Hence, the use of this population in quantitative research must await the time when this custom is corrected and good dosimetric data are collected routinely. In many respects, this means that such research will depend upon the development and application of instrumentation by which radiation measurements may be made easily and reliably in medical practice.

We come now to the question, what measurements should be made during a diagnostic x-ray procedure to yield data of the greatest value from an epidemiological standpoint. The answer is somewhat complicated by the fact that the absorbed dose received by a critical organ may in some instances be the result of radiation reaching the organ directly from the x-ray tube and, in others, of radiation scattered from adjoining tissue.

For critical tissues which fall within the useful beam, the most important measurement is perhaps the exposure dose prevailing at the incident skin surface, measured in roentgens. If the position of the critical tissue below the skin is known, the dose received by the tissue can be determined reasonably well from exposure dose values.

For critical tissues which lie outside of the useful beam, tissue dose is not only a function of the exposure dose prevailing at the incident skin surface but also of the

size of the irradiated field and its location relative to the critical tissue. Now the collective influence of exposure dose and field size on the dose received by a remote tissue from scattered radiation is a function of the total energy contained within the x-ray beam as it falls on the patient. Hence, where one deals with the exposure of critical tissues from scattered radiation, measurements of the total radiant energy incident on the patient are of prime importance. This is particularly true when, as in fluoroscopy, measurements of field size are difficult.

If good operating procedure is followed in the performance of a radiographic or fluoroscopic examination, exposure of gonadal structures to the useful beam will not occur in most instances. Such exposure as does occur will be from scattered radiation. Measurement of the total radiant energy received by patients undergoing diagnostic x-ray examination, therefore, is essential to the investigation of the genetic effects which may arise from such procedures.

In respect to leukemogenic effects, total radiant energy values again are perhaps more significant than exposure dose. Since the hematopoietic tissues are widely distributed throughout the body, one is not concerned with the quantity of radiant energy absorbed by a highly localized tissue, reflected by exposure dose values, but by the energy absorbed through a considerable volume of tissue both within and without the useful beam, that is, total incident radiant energy. The same is true in relation to the aging effects of radiation, where the critical tissues also are widely distributed.

From the foregoing, it is clear that in the epidemiological study of many biological effects of diagnostic x-ray procedures it is important that data be available routinely on the total energy contained within the x-ray beams of equipment used in practice. Also, it is necessary that data be available on the relationships between radiant energy values and tissue dose for the various types of radiographic

and fluor  
various cr  
uation of  
subject o  
laborator  
data sho  
The des  
which th  
an x-ray  
subject o

Fig.

MEASURE  
DELIVERED

A num  
to devel  
the tota  
patients  
scopic ex  
most su  
Reinsma  
chamber  
in the x  
in radiog  
the shut  
Since th  
beam pr  
less of w  
small or  
portional  
to the p  
designe  
reasonab  
the exp

and fluoroscopic examinations and for the various critical tissues. Quantitative evaluation of these relationships has been the subject of intensive study in a number of laboratories for some time, and increasing data should be published in the future. The description of instrumentation by which the total energy contained within an x-ray beam may be measured is the subject of the remainder of this paper.

is connected to a suitable electrometer system with which radiant energy levels may be recorded by the technician.

Although the Reinsma instrument marks a sharp step forward in equipment to measure the total radiant energy received by patients during fluoroscopy and radiography, it has a few shortcomings. First, the spectral response is not entirely independent of radiation quality. Also, the

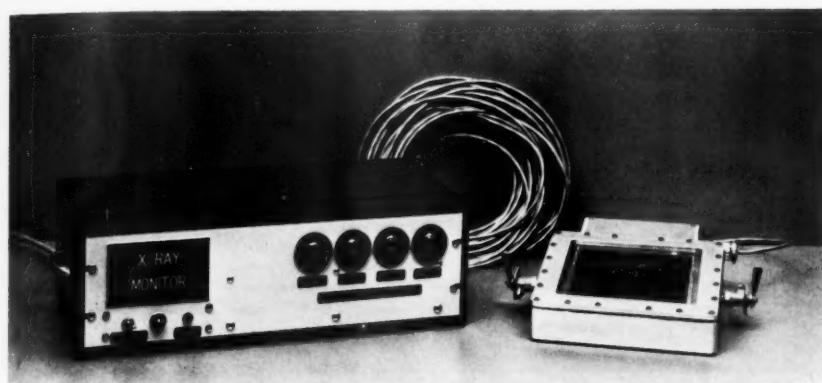


Fig. 1. X-ray monitor, which measures total radiant energy projected on patients during radiographic and fluoroscopic exposures.

#### MEASUREMENT OF THE RADIANT ENERGY DELIVERED TO THE PATIENT IN DIAGNOSTIC X-RAY PRACTICE

A number of attempts have been made to develop instruments which measure the total radiant energy delivered to patients during radiographic and fluoroscopic examination (2, 3, 4). One of the most successful is that designed by Reinsma. This includes an ionization chamber of special construction located in the x-ray beam, just beyond the cone in radiographic apparatus and just beyond the shutters in fluoroscopic equipment. Since the chamber intercepts the total beam projected toward the patient regardless of whether the field of examination is small or large, measurements are proportional to total radiant energy delivered to the patient. The chamber has been designed so that its spectral response is reasonably independent of the quality of the exposing radiation throughout the diagnostic x-ray spectrum. The chamber

ionization chamber is opaque to light and hence prevents the technician from seeing the field of exposure when adjustable cones with light beams are employed. Finally, the electrometer circuit, although superbly designed, is quite complicated from the standpoint of technician operation. In an effort to overcome some of these defects, research was undertaken on a radiant energy instrument of improved design in our laboratories. The instrument which has been developed is shown in Figure 1. Since its primary function is as a monitor of the total radiant energy delivered to patients in diagnostic radiology, it will be referred to in this paper as an x-ray monitor. It measures radiant energy levels in absolute units of millijoules (1 millijoule equals 10,000 ergs).

The instrument consists of (a) an ethane-filled ionization chamber and an electrometer circuit, which are mounted directly on the exit surface of an adjustable

radiographic collimator or on suitable brackets in front of the shutter assembly of a fluoroscope, and (b) a recording circuit and power supply which may be located at the x-ray control panel. The two units are connected by an appropriate electrical cable.

(a) *Chamber Design:* As shown in Figure 2, the ionization chamber consists of two superimposed sections. The upper

light transmission. In normal operation, x-rays pass first through the upper section and then through the lower section on their way to the patient.

The lower wall of the upper section and the upper wall of the lower section of the chamber are connected to each other electrically and serve as the collecting electrode on which the charge developed in both sections of the chamber is delivered to

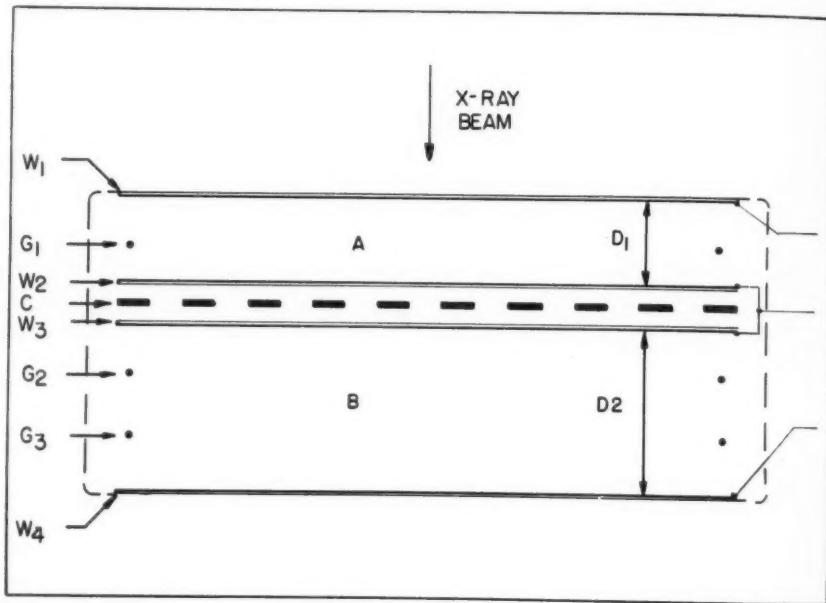


Fig. 2. Schematic diagram of ionization chamber of x-ray monitor.

section (A), 1 cm. in depth, is bounded above and below by transparent polystyrene walls,  $W_1$  and  $W_2$ . The lower section (B), 2 cm. in depth, is bounded by similar walls,  $W_3$  and  $W_4$ . The two sections are separated by a 50 per cent perforated copper layer (C) 0.09 mm. thick. The perforations of the copper are sufficiently small that they cast no perceptible radiographic or fluoroscopic shadow. In each section, the opposing wall surfaces are aluminized in order that they may be electrically conductive. The thicknesses of the aluminum layers, however, are sufficiently thin that they do not materially affect the response of the chamber nor do they substantially impair the chamber's

the electrometer circuit. To insure proper collection of this charge, the upper wall of the upper section is connected to a negative power supply of approximately 200 volts and the lower wall of the lower section to a positive power supply of approximately 800 volts. These potentials are sufficient to insure collection of at least 95 per cent of the charge produced within the chamber when it is mounted at the end of a limiting cone or collimator 12 inches from the x-ray target and when the tube operates at currents and potentials as high as 500 ma and 125 kvp, respectively. Electric field uniformity within the chamber is maintained by guard rings,  $G_1$ ,  $G_2$ , and  $G_3$ .



Fig. 3.  
a function  
ation. The  
the respons  
detector co  
diameter a  
multiplier.  
was located  
the monitor  
during radi  
reaching the  
0.4 inch.  
absorbs ess  
(1), and h  
radiant ener

The a  
of the cl  
square.  
the char  
x-ray be  
how larg

The first chosen, first response question extending (see Fig. 1) cation of measures and, secondly, parent to interfere with on which

Parent pointed ionization radiant roentgen response low photo in curve tion cu chamber energy

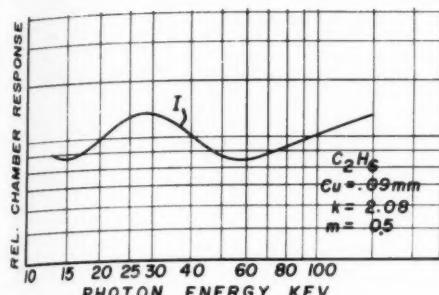


Fig. 3. Relative response of x-ray monitor plotted as a function of the half-value layer of the incident radiation. These measurements were made by comparing the response of the instrument with that of a radiation detector consisting of a sodium iodide crystal, 1 inch in diameter and 0.5 inch in thickness, and a photomultiplier. During the measurements, the detector was located directly below the ionization chamber of the monitor in a position similar to that of a patient during radiography or fluoroscopy. Also, radiation reaching the crystal was collimated to a diameter of 0.4 inch. Under these circumstances, the crystal absorbs essentially 100 per cent of the incident radiation (I), and hence detector readings are proportional to radiant energy transmitted by the monitor.

The active surfaces of both sections of the chamber are approximately 15 cm. square. They are of sufficient size that the chamber intercepts the entire useful x-ray beam regardless of how small or how large a field may be selected.

The foregoing chamber design has been chosen, first, because it provides a chamber response relatively independent of radiation quality for a half-value layer range extending from 0.5 mm. Al to 10 mm. Al (see Fig. 3) and hence requires the application of no correction factors to chamber measurements as radiation quality changes and, second, because the chamber is transparent to light and thereby will not interfere with the use of light-beam collimators on which it may be mounted.

Parenthetically, it perhaps should be pointed out that conventional air-wall ionization chambers are not suitable for radiant energy measurements in diagnostic roentgenology because of the excessive response exhibited by these chambers at low photon energies. This is well shown in curve A of Figure 4, where the ionization current produced in an air-wall chamber is plotted as a function of photon energy for an x-ray beam of constant

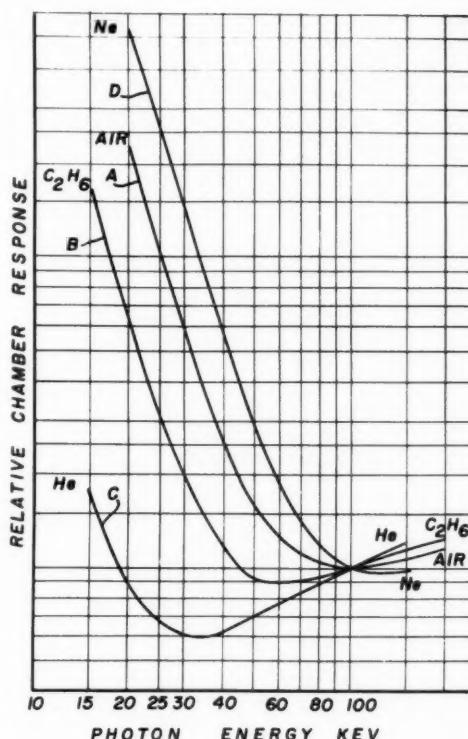


Fig. 4. Relative energy response of conventional ionization chambers plotted as a function of photon energy. A. Air-wall ionization chamber. B. Polyethylene chamber filled with ethane. C. Helium-filled lithium chamber. D. Neon-filled, neon-equivalent chamber.

radiant intensity (*i.e.*, constant radiant energy/sq. cm./second). It will be observed that the response of the chamber is far from independent of radiation quality. The same is true of polyethylene chambers filled with ethane (curve B), helium-filled chambers made with lithium walls (curve C), and neon-filled chambers with neon-equivalent walls (curve D). The excessive response characteristic of all these chambers at low photon energies is caused by the increasing photoelectric absorption of the gas contained in each as photon energy is reduced. Differences between chambers are due to differences in the atomic composition of their gases and hence their photoelectric absorption.

The reasons why the ionization chamber illustrated in Figure 2 responds uniformly

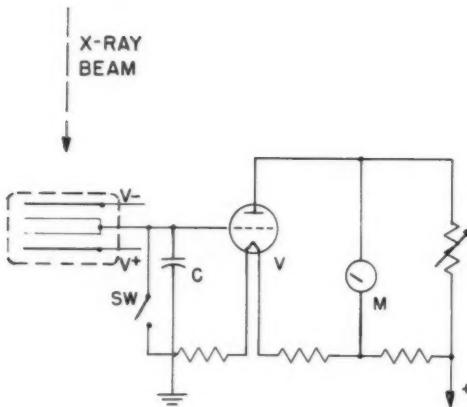


Fig. 5. Schematic diagram of conventional electrometer circuit for measurement of charge produced in an ionization chamber.

to equal quantities of transmitted radiant energy, regardless of radiation quality, are given in the Note appended to this paper. The following is a summary of this discussion:

Since the thicknesses of the several polystyrene walls of the chamber are small, their x-ray attenuation is negligible. Therefore, when an x-ray beam passes through the chamber, the ionization current developed in the entire upper section will equal the ionization current developed in that part of the lower section where the beam passes through the perforations of the interchamber copper layer. This is so because, although the lower chamber has twice the volume of gas of the upper chamber, only one-half of the beam passes through the perforations, since perforated and nonperforated areas of the interchamber layer are equal. Since these currents are opposite in direction, due to the polarities of the potentials applied to the chamber sections, they cancel out. Hence, the only current measured by the chamber is that due to the ionization of gas in the lower chamber section by x-rays passing through the nonperforated portions of the interchamber layer. Since the metal in this layer attenuates low-energy photons more than those of high energy, compensation for the high photoelectric absorption coefficient of ethane at low

photon energies is obtained. Also, since the radiation received by the patient is a mixture of attenuated and nonattenuated radiation, the compensation is more effective than if the interchamber layer were unperforated.

The response of the chamber across its active surface is uniform within limits of  $\pm 5$  per cent. Therefore, the chamber is able to measure faithfully radiant energy values to this precision regardless of the size of the field being irradiated.

(b) *Electrometer Circuit Design:* Let us now turn our attention to the electrometer circuit with which the current delivered by the ionization chamber is measured. This circuit is essentially an analog-to-digital converter and leads to an instrument which is unusually simple in operation.

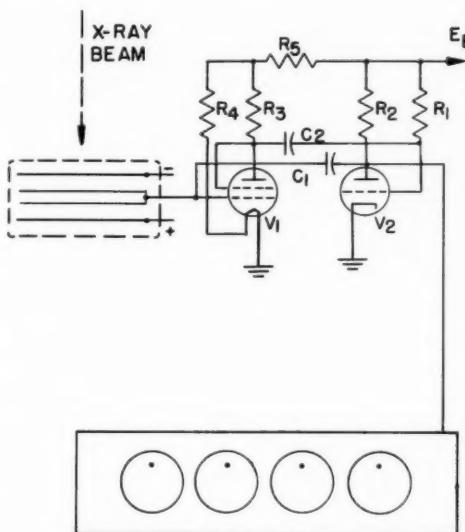
Conventionally, the charge developed in an ionization chamber during a radiation exposure is collected by a capacitor, whose resulting potential is measured by a suitable electrometer. One of the most convenient of these devices is the electrometer vacuum tube. Figure 5 illustrates a typical circuit employing such a tube. The collecting electrode of the ionization chamber is connected to the capacitor, C, and to the control grid of the electrometer tube, V. As a result of charge received by the capacitor from the ionization chamber, the potential of the control grid of the electrometer tube rises. This causes the current in the tube's plate circuit to increase, and the meter, M, to deflect. The meter, when calibrated, permits the quantity of radiation intercepted by the ionization chamber to be measured. After the exposure is completed and the reading recorded, the switch, SW, discharges the capacitor and thereby prepares the instrument for a subsequent measurement.

The circuit shown in Figure 5 has many shortcomings. In diagnostic roentgenography and fluoroscopy, the values of radiant energy to be measured range from a few millijoules to 10 or more joules—a range of several decades. The circuit illustrated will not cover this range unless

provision is made for variation of the capacitor,  $C$ , through a similar range. This can be done, of course, by suitable switching circuits. X-ray technicians, however, are usually not well versed in physical mensuration and hence are likely to find such circuits confusing and the cause of interpretive error. The circuit also requires several other adjustments which are time-consuming and may be the cause of malfunction. For example, before an exposure is made, the capacitor,  $C$ , must be discharged and the meter,  $M$ , adjusted to its zero position. If the operator reverses the sequence of this procedure, serious error may result. For practical application in medical x-ray work, therefore, what is needed is a circuit which (a) requires no adjustment of sensitivity within the range of radiant energies to be encountered, (b) automatically discharges the ion-current capacitor, and (c) requires no careful zero adjustment of meters or other devices displaying the energy data.

Such a circuit is shown in Figure 6. This circuit, which is used in the x-ray monitor, employs a single capacitor,  $C_1$ , to receive the current from the ionization chamber. One end of this capacitor is connected to the control electrode of the ionization chamber and to the control grid of an electrometer tube,  $V_1$ , as in conventional circuitry. The circuit differs from that in Figure 5, however, in that the electrometer tube and capacitor are arranged in a so-called multi-vibrator configuration with a second tube,  $V_2$ , a high-gain triode.

The circuit operates in the following manner. When the x-ray exposure begins, the electrometer tube,  $V_1$ , is normally in a nonconducting state, whereas the triode,  $V_2$ , is conducting. Under these conditions, the plate and grid voltages of  $V_2$  are close to ground potential and the voltage across the capacitor,  $C_1$ , is such that the grid of the electrometer tube is biased far negatively. When radiation falls on the ionization chamber, the potential of the capacitor,  $C_1$ , and the grid of



ELECTRONIC COUNTER

Fig. 6. Schematic diagram of electrometer circuit used in the x-ray monitor. The circuit operates as an analog-to-digital converter to yield an instrument of great simplicity.

the electrometer tube,  $V_1$ , rises and ultimately reaches a point where current flows in the tube's plate circuit. Thereupon the plate voltage of the electrometer tube diminishes because of the potential drop across the resistor,  $R_3$ . The grid potential of  $V_2$  also drops, because of its connection to the plate of the electrometer through capacitor  $C_2$ . This causes a reduction in the plate current of  $V_2$  and hence a rise in this tube's plate potential. Since the grid of the electrometer tube is connected to the plate of  $V_2$ , through  $C_1$ , this causes a further rise in the grid potential of the electrometer tube. This action of positive or regenerative feedback causes the grid potential of the electrometer tube to rise very rapidly now until it reaches ground potential. Simultaneously the plate of the electrometer tube draws sufficient current that it also approaches ground potential. This causes the grid of  $V_2$  to be driven far negatively (approximately equal to the level of the electrometer tube's plate supply) and hence the plate current of  $V_2$  is cut off. As a result, the plate of

$V_2$  rises to the potential,  $E_B$ , and the capacitor,  $C_1$ , becomes charged to this potential by way of current flowing from cathode to grid in the electrometer tube.

The electrometer tube remains conducting only briefly, because  $C_2$  rapidly charges positively through the resistor,  $R_1$ , and in less than 100 microseconds the grid potential of  $V_2$  rises until current flows in its plate circuit.<sup>2</sup> Thereupon, the plate potential of  $V_2$  falls rapidly to ground level, and the grid potential of the electrometer tube is driven far negatively by the potential on the capacitor,  $C_1$ . The plate current through the electrometer tube is therefore cut off and remains so until enough current flows from the ionization chamber into the capacitor,  $C_1$ , to trigger the cycle again. Each time that the circuit goes through its cycle, a pulse is generated across the resistor,  $R_2$ . This pulse may be used to drive a conventional electronic counting device such as a series of Dekatron counting tubes.

The charge delivered to the capacitor,  $C_1$ , by the ionization chamber during one cycle is proportional to the radiant energy received by the chamber in this interval. In the design of the instrument, the circuit parameters have been chosen so that one count represents the transmission by the chamber of 1 millijoule of radiant energy. Hence, when a measurement is made, one merely reads the number of counts recorded by the counter tubes to ascertain the radiant energy in millijoules delivered to the patient.

It will be seen from the foregoing description of the electrometer circuit that no adjustments are needed for its normal operation. Indeed, no manipulation of any kind is required except for the simple pushing of a reset switch at the end of each exposure in order to prepare the

<sup>2</sup> It is desirable that the electrometer tube conduct for only a brief time since during this period any charge delivered by the ionization chamber to  $C_1$  will be lost. That is, the time that  $V_1$  is conducting is dead time as far as charge collection is concerned. In medical practice dead times as long as 100 microseconds are permissible in most cases. Where they are not, much shorter times may be easily obtained by minor circuit modification.

instrument for the next exposure. There is no charging or discharging of capacitors and no zero adjustment of meters to be performed. Also when a measurement is made, its reading continues to be displayed until the reset button is pushed. The radiologist or technician is thereby given ample time to record the measurement without fear that the reading will change.

Since the instrument is a device which integrates radiant energy both temporally and spatially, measurements are made without the operator being required to determine the area of the irradiated field or the exposure time. Also, since the response of the instrument is uniform at all photon energies, measurements may be made without correction for kilovoltage and beam filtration. Instrument operation is therefore unusually simple.

It has been found desirable to provide in the instrument a counting range of four decades; that is, extending from a lower limit of 1 millijoule to an upper limit of 9,999 millijoules. Simple anteroposterior chest films of an adult usually require the delivery of no more than 5 millijoules of energy; examination of the colon with fluoroscopy and several 14  $\times$  17-inch films, on the other hand, may require more than 1,000 millijoules. Since in the hands of inexperienced fluoroscopists and technicians these values may rise considerably higher, a wide counting range has been provided in the instrument.

It perhaps might be well at this point to discuss for a moment the units of radiant energy in which the instrument has been calibrated, namely, the millijoule and its multiples. At one time, we were tempted to follow the practice of Reinsma, who has calibrated his instrument in terms of the gram-rad, a unit which at first glance may seem preferable, since it is the unit of integral dose and hence is more familiar to radiologists and their technicians. The reason why one has a choice between the two units is that both are dimensionally equivalent; 1 gram-rad is equivalent to 0.01 millijoule of radiant

energy a  
rad is e  
the total  
a patient  
this may  
types of  
for exam  
of struct  
tion is s  
radiatio  
ries. F  
to calib  
units of  
joule, a  
the signi  
  
Altho  
has been  
principal  
its simpl  
radiatio  
makes it  
radiatio  
practice.  
past few  
concern  
of ionizin  
radiatio  
during th  
fluorosc  
concern  
authorit  
data sho  
hospitals  
tients w  
cedures  
hospitals  
partial  
ployed  
x-ray p  
ficient i  
particula  
irradiat  
fluorosc  
not be  
do not  
cerning  
posure r  
ment o  
difficulty

energy absorbed. However, if the gramrad is employed, the assumption is that the total radiant energy projected toward a patient is absorbed by him. Although this may be very nearly true for many types of x-ray examination, it is not true for examinations of thin structures and of structures where the field of examination is sufficiently large that some of the radiation passes outside of patient boundaries. For this reason we have decided to calibrate the instrument in absolute units of radiant energy, namely, the millijoule, and to remove all doubt regarding the significance of the readings.

#### DISCUSSION

Although the instrumentation which has been described here has been designed principally for epidemiological research, its simplicity of use plus its provision of radiation measurements in absolute terms makes it ideal for the routine recording of radiation exposure data in diagnostic x-ray practice. As is well known, during the past few years there has been increasing concern regarding the biological effects of ionizing radiation and, in particular, the radiation to which the public is exposed during the diagnostic medical procedures of fluoroscopy and roentgenography. This concern is sufficiently great that many authorities believe that accurate exposure data should be recorded in the files of all hospitals and professional offices for patients who have had diagnostic x-ray procedures performed there. Although some hospitals and professional offices maintain partial records of the exposure data employed in the conduct of their medical x-ray procedures, they are usually deficient in one or more respects. This is particularly so in records of the size of the irradiated field. Indeed, in the case of fluoroscopic procedures, the field size cannot be measured. Therefore, the data do not provide reliable information concerning the extent of the radiation exposure received by a patient. The instrument described here circumvents this difficulty by providing a precise measure-

ment of the radiant energy delivered to patients regardless of field size. Furthermore, values of the delivered radiant energy are valid in spite of miscalibrations of the x-ray equipment. Finally, the radiologist and technician, by the recording of a single number, are able to place in the record perhaps the one most important piece of information pertaining to radiation exposure of all the data which may be obtained, namely, the quantity of radiant energy actually projected on the patient.

The routine recording of the radiant energy delivered to patients is likely to have an important influence on radiographic and fluoroscopic technic. In a given radiographic or fluoroscopic procedure, the radiant energy needed for the examination will not customarily vary through wide limits. Therefore, if an inspection of the record indicates that an examination has required an unusually large amount of radiant energy, it can be assumed that the x-ray equipment was defective or was operated improperly. For example, in a fluoroscopic procedure, if the delivered radiant energy is high, one can immediately assume that the shutters were too widely opened and/or the exposure time too long. Hence, the maintenance of records on the radiant energy delivered to patients should do much to insure that the exposure received by the population from medical x-ray sources is maintained at as low a level as possible. In general, few people question the freedom of the medical profession to use x-rays in diagnostic applications whenever they seem justified. Such freedom, however, does not carry with it the right to employ x-ray equipment unsafely. One way in which the improper use of equipment may be reduced to a minimum is through the use of apparatus which will measure easily and reliably the quantity of radiant energy delivered to patients in diagnostic roentgenology. If records of such exposure are maintained and periodically checked, those installations which are operating unsafely

or are used imprudently may be quickly spotted.

NOTE (see page 872): When an x-ray beam is projected through the ionization chamber illustrated in Figure 2, the ion current,  $i_1$ , produced in the upper section of the chamber by radiation of wave length  $\lambda$  is equal to

$$i_1 = -(E_\lambda g_1 d_1) \quad (1)$$

where  $E_\lambda$  is the energy of the radiation,  $g_1$  is a function of the absorptive component of the mass attenuation coefficient of the included gas, and  $d_1$  is the depth of the upper section of the chamber.

The current  $i_2$  in the lower section is

$$i_2 = E_\lambda g_2 d_2 m + E_\lambda g_2 d_2 (1 - m) e^{-\mu_{m\mu\lambda}} \quad (2)$$

where  $g_2$  is a function of the absorptive component of the mass attenuation coefficient of the gas in the lower section;  $d_2$  is the depth of the lower section of the chamber;  $\mu_m$  is the mass attenuation coefficient of the attenuating layer between the two chambers, and  $m$  is the fraction of the attenuating layer's area which is perforated.

Now if the ratio  $d_2/d_1$  equals  $k$ , then the total current,  $i$ , in the chamber from the radiation of wave length  $\lambda$  is

$$i = i_1 + i_2 = E_\lambda d_1 [g_2 k m + g_2 k (1 - m) e^{-\mu_{m\mu\lambda}} - g_1] \quad (3)$$

The energy  $E$ , of wave length  $\lambda$ , transmitted by the chamber and incident on the patient is as follows:

$$E = E_\lambda m + E_\lambda (1 - m) e^{-\mu_{m\mu\lambda}} \quad (4)$$

Therefore the response of the chamber relative to the energy incident on the patient is equal to

$$i/E = \frac{d_1 [g_2 k m + g_2 k (1 - m) e^{-\mu_{m\mu\lambda}} - g_1]}{m + (1 - m) e^{-\mu_{m\mu\lambda}}} \quad (5)$$

The terms in  $g$  and  $\mu_m$  in equation (5) are a function of the photon energy of the beam passing through the chamber. By proper adjustment of these parameters, the ratio of  $i/E$  remains relatively constant regardless of wave length. For example, if the gases in the upper and lower chambers are identical, so that  $g_1 = g_2$ , and if the product of  $m$  and  $k$  is made equal to unity, and if  $m$ ,  $k$ ,  $\mu_m$ ,  $\mu$ , and  $x$  are so chosen that

$$\frac{k(1 - m) e^{-\mu_{m\mu\lambda}}}{m + (1 - m) e^{-\mu_{m\mu\lambda}}}$$

is proportional to the reciprocal of  $g_2$ , the response of the chamber relative to the energy of the radiation falling upon the patient will be constant at all wave lengths.

Department of Radiology  
The Johns Hopkins Hospital  
Baltimore 5, Md.

#### REFERENCES

1. BERGER, M. J., AND RASO, D. J.: Monte Carlo Calculations of Gamma-Ray Backscattering. *Radiation Res.* 12: 20-37, January 1960.
2. FEDDEMA, J., AND OOSTERKAMP, W. J.: Volume Doses in Diagnostic Radiology. [In] *Modern Trends in Diagnostic Radiology*, ed. by H. W. McLaren. London, Butterworth & Co., Ltd., Second Series, 1953, pp. 35-42.
3. REINSMA, K.: The Evaluation of the Integral Absorbed dose in Diagnostic Roentgenology. *Medicamundi* 5: 41-46, 1959.
4. REINSMA, K.: Dosemeters for Measuring Integral Absorbed Doses in Medical X-Ray Diagnostic Investigations. Eindhoven, The Netherlands, N. V. Uitgeversmij. Centrex, 1960.

#### SUMMARIO IN INTERLINGUA

#### Le Mesuration del Nivellos de Energia Radiante in le Roentgenologia Diagnostic

Le hic describete apparato, primariamente construite pro recercas epidemiologic, pare esser ideal pro le registration del exposition radiatori in manovras diagnostic. Illo consiste de (a) un camera de ionisation plenate de ethano e un circuito electrometric, montate directemente super le superficie de exito de un adjustabile collimator radiographic o super appropriate patas de fixation ante le obturator de un fluoroscopio e (b) un circuito de registration con provision de energia le qual pote esser locate al tabula de controlo. Le duo uni-

tates es connectite per un appropriate cable electric.

Iste instrumento provide un mesuration precise del energia radiante delivrade al paciente, sin reguardo al dimensiones del campo. In plus, le valores obtenite pro le delivrade energia radiante es correcte in despecto de miscalibrations del apparatura de radios X. Finalmente, le radiologo e technico, per le registration de un sol numero, pote notar in le protocollo le quantitate de energia radiante que es de facto projicite super le paciente.

BECA  
has  
exposure  
ists (1  
dose be  
duced.  
doses, h

At the  
ology is  
exposure  
vidual,  
therapy  
source.

the poin  
emphas  
Natio  
lin and  
the num  
radiolog

year 19  
must b  
given b  
imated  
age gro  
The re  
diseas  
looked  
afflictio

Rece  
indicat  
has be  
therap  
posure  
deals w  
posure  
great  
howev  
ditions,  
early

1 Fro  
Present  
Dec. 4  
2 Assi  
3 Inst  
Hospital  
4 Pro

## Gonadal Exposure Incident to Roentgen Therapy<sup>1</sup>

GUSTAVE KAPLAN, B.S., M.D.,<sup>2</sup> CARL COLLICA, B.S.,<sup>3</sup> and SIDNEY RUBENFELD, M.D.<sup>4</sup>

BECAUSE OF ITS genetic effect, there has been much concern about gonadal exposure to man-made radiation. Geneticists (1) feel that there is no threshold dose below which mutations are not produced. Low doses are mutagenic, and all doses, however distributed, are cumulative.

At the present time, diagnostic radiology is the major contributor to gonadal exposure of the populace. To the individual, however, exposure from radiotherapy is greater than that from any other source. The scope of the problem from the point of view of roentgen therapy is emphasized in the study made for the National Academy of Sciences by Laughlin and Pullman (2) who estimated that the number of x-ray treatments given by radiologists to persons under thirty in the year 1955 was 1.9 million. To this figure must be added the number of treatments given by dermatologists. Clark (3) estimated that 25 per cent of treatments in all age groups are for nonmalignant ailments. The remaining 75 per cent are for malignant diseases, where genetic effects are overlooked because of the severity of the affliction.

Recent reports in the literature (4-10) indicate that comparatively little attention has been paid to the role of roentgen therapy as a contributor to gonadal exposure. It is true that the radiotherapist deals mainly with patients who have advanced malignant tumors, where the exposure received by the gonads is not of great significance. It is equally true, however, that he treats many benign conditions as well as certain malignant conditions, such as postoperative seminomas and early lymphomas in the young, where

irradiation of the gonads may be of importance. The classic description of administration of radiotherapy invariably fails to mention protection of the gonads. The emphasis has rather been to shield normal tissues adjacent to the treatment field, radiotherapists having only recently become aware of the importance of gonadal shielding.

It was with the foregoing considerations in mind that the study to be reported here was undertaken.

### MATERIALS AND METHODS

A series of measurements were made on male patients of varying habitus undergoing treatment for tumors in various sites. A 260-kv, self-rectified x-ray unit with a Regato field localizer was used for this investigation. Measurements of radiation around the gonads were made with a specially constructed cylindrical condenser type ionization chamber (Fig. 1) whose wall thickness was 1 mm. of Lucite with a collecting wire of 0.5 mm. Al. The volume of the chamber was 187 c.c., which is approximately the volume of the average adult male gonads. The chamber was used with a Victoreen electrometer, and the complete set was calibrated against a standard air-wall chamber. A "step-ladder" Masonite pedestal in increments of 0.5 inch made possible height adjustment of the ionization chamber to the precise level of the gonads.

The following constant factors were used: 250 kv, Thoraeus filter (h.v.l. 2.3 mm. Cu), 200 kv, 0.5 mm. Cu filter (h.v.l. 1.1 mm. Cu). Treatments were delivered perpendicular to the skin at a skin-target distance of 50 cm.

<sup>1</sup> From the New York University School of Medicine and the New York Veterans Administration Hospital. Presented at the Forty-sixth Annual Meeting of the Radiological Society of North America, Cincinnati, Ohio, Dec. 4-9, 1960.

<sup>2</sup> Assistant Clinical Professor of Radiology; Radiologist, New York Veterans Administration Hospital.

<sup>3</sup> Instructor in Radiology (Radiologic Physics); Attending in Physics, New York Veterans Administration Hospital.

<sup>4</sup> Professor of Clinical Radiology; Consultant Radiologist, New York Veterans Administration Hospital.

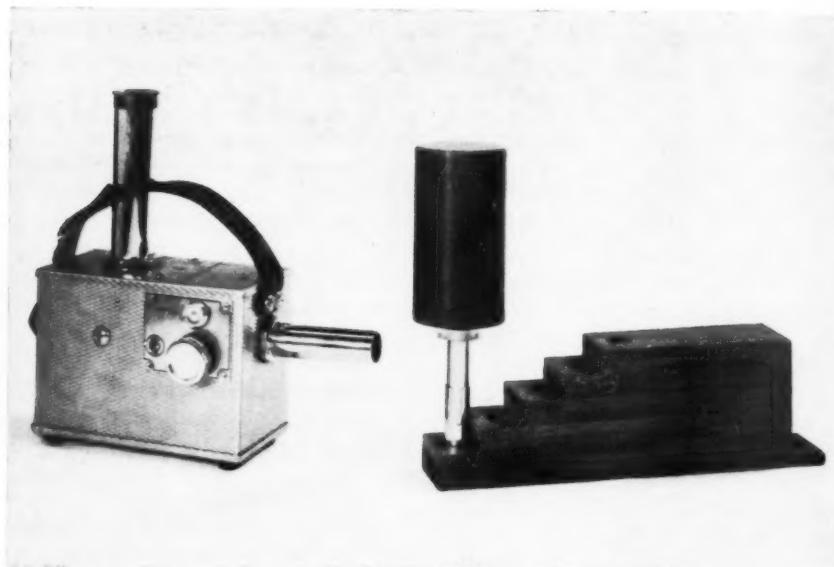


Fig. 1. Cylindrical ionization chamber of 187 c.c. volume, the stem of which is inserted into one of the steps of the Masonite pedestal.

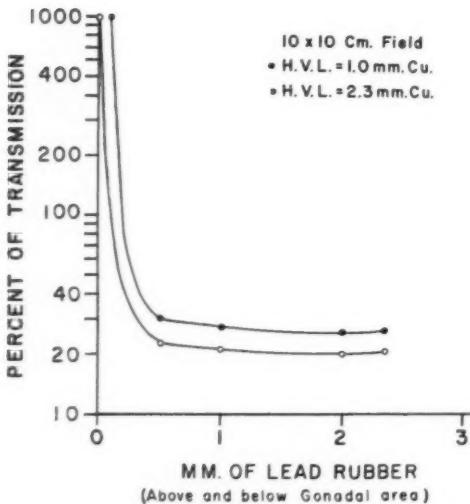


Fig. 2. Absorption curves in lead rubber, showing that there is no appreciable diminution in gonadal exposure with additional absorber beyond 0.5 mm.

The variables in the study were the size of the fields ( $6 \times 8$ ,  $8 \times 10$ ,  $10 \times 12$ ,  $15 \times 15$  cm.), the distance from the center of the field to the gonads (F.G.D.), and the habitus of the patient.

Measurements were taken (a) with varying lead thicknesses to obtain the op-

timum amount of protection; (b) with no lead protection of the gonads; (c) with lead rubber equivalent of 0.5 mm. (2  $\times$  2 feet) placed above the gonads; (d) with lead rubber equivalent of 0.5 mm. (2  $\times$  2 feet) placed above and below the gonads.

#### RESULTS

Figure 2 is an absorption curve in lead rubber. It shows that there is only a minimal reduction in gonadal exposure when the thickness of lead rubber is increased above 0.5 mm. Therefore, this thickness was chosen as the optimum protective covering. The protective covering absorbs, to an extent, tube leakage and external scattered radiation, but cannot absorb internal scatter produced throughout the long axis of the body. For this reason, there is no appreciable decrease in gonadal exposure with increased thickness of lead rubber.

Figure 3 effectively demonstrates the need for protective covering below as well as above the gonadal area.

The effects of distance from the center of the field and area are as to be expected,

i.e., the  $\frac{1}{r^2}$  reduction with increasing distance.

Figure 4 demonstrates the scatter factor of Cu h.v.l.

2000  
1000  
600  
400  
200  
100  
60  
40  
20  
10  
1

Fig. 3.  
of protective  
Minimum  
protected  
tion. B.  
C. With  
gonads.

mm. C  
from a  
approx.  
The pe  
as side  
softer  
coeffici  
greater

With  
50 cm.  
exposu  
radiati  
than 5  
between  
ionizat  
sorb th  
lower  
40 cm  
scatter

i.e., the exposure to the gonads diminishes with increased distance and decreases with reduction in size of treatment field (Figs. 4 and 5).

Figure 6 demonstrates that the side-scatter from a primary beam of 2.3 mm. Cu h.v.l. is equivalent to a quality of 1.5

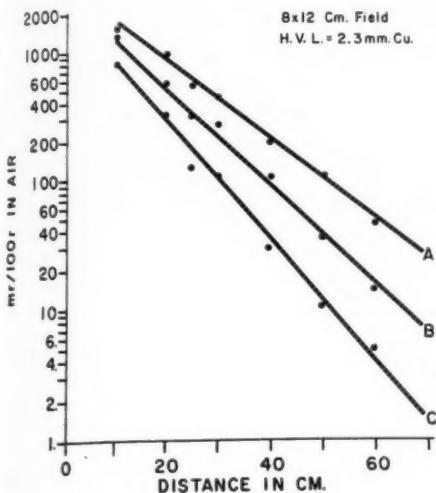


Fig. 3. Curves emphasizing the relative inadequacy of protective covering placed only above the gonads. Minimum exposures are obtained when the gonads are protected both above and below. A. Without protection. B. With 0.5 mm. lead rubber above the gonads. C. With 0.5 mm. lead rubber both above and below gonads.

mm. Cu h.v.l. The quality of the scatter from a beam of 1.1 mm. Cu h.v.l. is approximately 0.6 mm. Cu h.v.l. (11). The percentage of primary x-rays ending as side-scatter is higher for radiation of softer quality and its linear absorption coefficient is approximately 60 per cent greater.

With fixed gonadal distances exceeding 50 cm. and less than 40 cm., the gonadal exposure is higher with higher quality radiation at field-gonadal distances greater than 50 cm., because the volume of tissue between the primary x-ray beam and ionization chamber is insufficient to absorb the scatter. Gonadal exposure with lower quality radiation at distances below 40 cm. increases because of greater side-scatter.

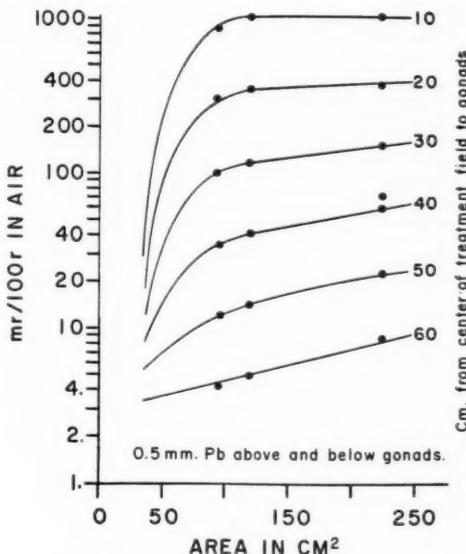


Fig. 4. Composite graph obtained from a primary beam of 2.3 mm. Cu h.v.l., showing gonadal exposure as a function of area and field-gonadal distance.

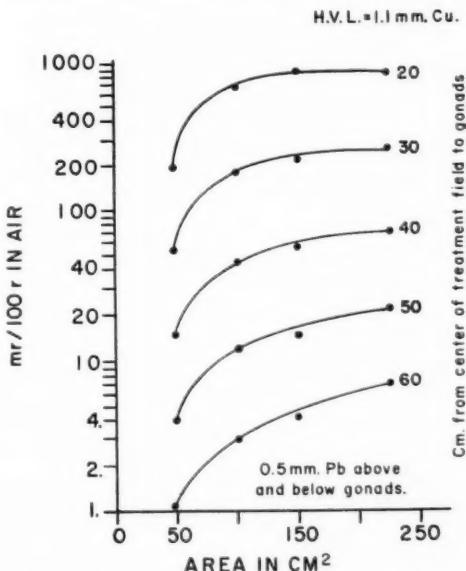


Fig. 5. Composite graph obtained from a primary beam of 1.1 mm. Cu h.v.l., showing gonadal exposure as a function of area and field-gonadal distance.

#### SUMMARY AND CONCLUSIONS

- Attempts should be made to minimize as much as possible exposure to the gonads during roentgen therapy for benign

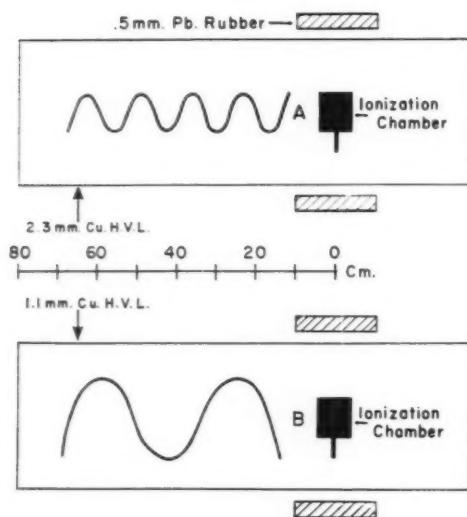


Fig. 6. Differences in quality and percentage of scattered radiation along the long axis of the body with x-rays of 2.3 and 1.1 mm. Cu h.v.l.

A. Primary beam, 2.3 mm. Cu h.v.l.; scattered radiation, 1.5 mm. Cu h.v.l.; dose rate, 0.3 per cent of primary.

B. Primary beam, 1.1 mm. Cu h.v.l. scattered radiation, 0.6 mm. Cu h.v.l.; dose rate 0.4 per cent of primary.

conditions. Complete elimination of gonadal exposure is apparently impossible because of the phenomenon of internal scatter within the long axis of the body.

2. Covering the gonads with lead above is insufficient; minimal exposure is obtained only with coverage *above and below*.

3. The optimum thickness of lead for protection is 0.5 mm.

4. Curves are presented which permit

direct readings of gonadal exposure as functions of distance to the gonads, treatment-field size, and half-value layer.

ACKNOWLEDGMENT: The authors express appreciation to Mr. Raymond Kahn, radiation technician, for development and construction of the Masonite pedestal and for his invaluable technical assistance. Also, thanks are offered to the Medical Illustration Department for their skillful preparation of the illustrations.

New York VA Hospital  
New York 10, N. Y.

#### REFERENCES

1. Radiation Hazard: Transcription of a Panel Meeting. (Rall, J. E., Moderator). Bull. New York Acad. Med. **36**: 804-825, December 1960.
2. LAUGHLIN, J. S., AND FULLMAN, I.: Gonadal Dose Produced by the Medical Use of X-rays. Washington, D. C., National Academy of Sciences—National Research Council, 1957.
3. CLARK, S. H.: Genetic Radiation Exposures in the Field of Medicine. Bull. Atomic Scientists **12**: 14-18, January 1956.
4. KOREN, K., AND MAUDAL, S.: Gonad Doses Received During the Medical Application of Roentgen Radiation. Acta radiol. **48**: 273-279, October 1957.
5. PURSER, P. R., AND QVIST, C. F.: An Estimate of the Genetic Dose from Radiotherapy. Acta radiol. **48**: 267-271, October 1957.
6. BAILY, N. A., YODER, V. E., AND BOZZINI, M. A.: Gonadal Dose in Radiation Therapy. Radiology **74**: 820-823, May 1960.
7. BRETLAND, P. M.: Relative Effectiveness of Testicular Shielding in Diagnostic Radiology. Acta radiol. **51**: 465-472, June 1959.
8. BISHOP, H. A., WEBBER, M., AND O'LOUGHLIN, B. J.: Reducing Gonad Irradiation in Pediatrics. California Med. **90**: 20-25, January 1959.
9. HORN, C. A.: Reduction of Radiation Exposure in Diagnostic Examinations. M. J. Australia **46**: 513-517, April 1959.
10. LICH, R., JR., AND BUMSTEAD, H. O.: Prevention of the Radiation Hazard in Diagnostic Urology. South. M. J. **52**: 482-483, April 1959.
11. HOLLOWAY, A. F.: Stray Radiation from Therapeutic Roentgen-Ray Beams. Am. J. Roentgenol. **85**: 152-157, January 1961.

#### SUMMARIO IN INTERLINGUA

#### Exposition Gonadal, Occasionate per Roentgeno-Therapia

Un cylindriforme camera de ionisation tipo condensator rendeva possibile determinaciones del dose de radiation delivratate al gonades masculine in un serie de pacientes sub tractamento a radios X. Le mesuraciones esseva facile sin protection plumbic del gonades e con varie spissitates de plumbo.

Esseva trovate que un spissitate de 0,5 mm de caucho a plumbo representava le mejor coperitura protective. Le elimi-

nation complete del exposition gonadal es apparentemente impossibile a causa del dispersion interne intra le axe longe del corpore. Pro effectuar un protection efficace, le placiamento de caucho a plumbo tanto supra como etiam infra le gonades es necessari.

Le exposition gonadal es un function del distantia inter campo e gonades, del dimension del campo, e del spissitate de media valor.

FOR A  
F (J. A  
the relati  
bed after  
malignan  
concern h  
In an ec  
we shou  
x-rays (2  
extreme  
garding r  
made to  
toms, fo  
in infants

Phanto  
six year  
structed  
forms w  
proximat  
filled wi  
firmly.  
lungs, w  
mediasti

A 250  
therapy  
with filt  
Cu, h.v.  
skin dist  
was giv  
Medical  
0-3 mm  
Al, and

Treat  
manag  
nonmali  
fants an  
total dos  
instance

Since  
any inst  
pocket  
the me  
pocket

# Gonadal Dosage in Pediatric Radiotherapy<sup>1</sup>

JOHN L. GWINN, M.D., DAVID C. GASTINEAU, M.D., and JOHN A. CAMPBELL, M.D.

FOR A NUMBER of years, one of us (J. A. C.) has been concerned about the relative value of irradiating the renal bed after *in toto* surgical removal of a malignant tumor such as Wilms'. This concern has also been stated by others (1). In an editorial, Raventos asks whether we should stop treating children with x-rays (2). In view of this, as well as the extreme interest and wide publicity regarding radiation hazards, an attempt was made to measure gonadal doses, in phantoms, for simulated radiation procedures in infants and children.

## METHODS

Phantoms of children aged six months, six years, and twelve years were constructed of papier-mâché. The paper forms were several layers thick and approximated the skin. They were then filled with rice which was packed quite firmly. Sponge rubber was used for the lungs, with tightly filled rice bags as the mediastinal structures.

A 250-kv General Electric Maximar therapy unit was used for deep therapy, with filtration of 1 mm. Al and 0.5 mm. Cu, h.v.l. of 1.4 mm. Cu, and a target-skin distance of 50 cm. Superficial therapy was given by a Westinghouse 150-kv Medical X-Ray Unit with filtration of 0.3 mm. Al, a h.v.l. of 0.5 to 4.4 mm. Al, and a target-skin distance of 29 cm.

Treatment areas that are used in the management of various malignant and nonmalignant disorders occurring in infants and children were simulated. The total dosage employed was modified in some instances to obtain a greater range.

Since in this study the gonad was not in any instance in the direct beam, a Victoreen pocket dosimeter, Model 362, was used for the measurements. The accuracy of the pocket dosimeter has been shown to be

reasonably satisfactory (3). Two dosimeters were used and both were checked against a Victoreen 250-mr chamber. In the male, the dosimeter was taped in the region of the scrotum. In the female, a tube was placed across the pelvis in the areas of the ovaries and the dosimeters were positioned within this tube. All measurements were repeated many times, and the results reproduced well.

## RESULTS

All of the results are recorded in the accompanying tables, which, for easy comparison, are grouped according to different anatomical locations.

The area of treatment, port size, and other data are recorded for each procedure. The dosages employed are not necessarily those used in actual treatment, but some were selected for convenience.

During treatment of the phantom of the twelve-year-old, dosages were recorded with the gonads uncovered and also with lead shielding.

During the course of this study, it was discovered that some radiation escaped from the surface of our x-ray tube housing at joints other than at the aperture for the primary beam. Hence, to study the reduction of the gonadal dose to the greatest practical degree, measurements were made with a skin covering of 2 mm. of lead rubber. Reductions were significant in almost every instance, varying from 40 to 90 per cent. Since the testicles are essentially superficial organs, the component of the gonadal dose from scatter within the body is low, while that from the tube housing is high. Therefore, a significant shielding can be achieved with a small thickness of lead rubber. The reduction in dosage to the ovaries with similar shielding is also significant but less dramatic, because of the relatively

<sup>1</sup>From Indiana University Medical Center, Indianapolis, Ind. Accepted for publication in January 1961.

TABLES I AND II: GONADAL DOSES WITH RADIOTHERAPY OF HEAD AND NECK AND CHEST

## HEAD AND NECK

LESION	No. Ports	Fac- tors*	DOSE (r)		Port Size	GONADAL DOSE IN ROENTGENS					
			Tumor	Air		MALE	6 MOS. 6 YRS. U 12 YRS. C	FEMALE	6 MOS. 6 YRS. U 12 YRS. C		
<u>Eosinophilic Granuloma</u>	1	1	600	700	5 x 5	-	0.574	0.23 - 0.02	-	0.560	0.15 - 0.050
<u>Hemangioma</u>	1	3	400	600	3 x 4	0.03	0.003	-	0.018	0.007	-
<u>Ringworm</u>	5	3	500	300 EACH PORT	12 x 12	-	0.045	0	-	0.060	0
<u>Acne</u>	1	4	500	400	10 x 10	-	0.000	0	-	0.007	0
<u>Eczema</u>	1	4	350	300	10 x 10	0.040	0.000	0	0.035	0.003	0
<u>Hygroma</u>	1	2	500	650	8 x 8	0.040	0.031	-	0.045	0.143	-
<u>Medulloblastoma</u>	3	1	2000	-	-	4.67	2.8	0.8 - 0.12	4.31	2.51	0.6 - 0.44
<u>Lymphoma (Nasopharynx)</u>	2	1	1200	1600 - 2000	5 x 5	-	2.200	0.55 - 0.05	-	2.0	0.40 - 0.12
<u>Neck Nodes</u>	1	1	1200	1150	5 x 5	2.9			2.6		
				1150	7 x 7		1.452			1.14	
				1150	7 x 7			0.78 - 0.085			0.40 - 0.24
<u>Lymphoid Tissue (Nasopharynx)</u>	2	1	500	800	5 x 5	-	0.980	-	-	0.80	-

## CHEST

LESION	No. Ports	Fac- tors*	DOSE (r)		Port Size	GONADAL DOSE IN ROENTGENS					
			Tumor	Air		MALE	6 MOS. 6 YRS. U 12 YRS. C	FEMALE	6 MOS. 6 YRS. U 12 YRS. C		
<u>Thymus</u>	1	2	400	550	6 x 6	0.95	-	-	1.35	-	-
<u>Keloid</u>	1	4	1500	-	1 x 4	0.004	0.003	0.001	0.006	0.007	0.001
<u>Hemangioma</u>	1	3	400	600	3 x 4	0.020	0.003	-	0.036	0.007	-
<u>Eczema</u>	1	3	300	-	10 x 20	0.210	0.036 (COVERED)	-	0.500	0.186 (COVERED)	-
<u>Asthma</u>	1	1	-	200	15 x 15	-	0.310	0.28 - 0.10	-	0.41	0.32 - 0.15
<u>Metastatic Pulmonary</u>	1	1	1000 - 1500	1300 - 2000	8 x 10 8 x 10 12 x 15	4.264 6.56 1.61 2.40		8.360 - 4.46 144 - 72 1.75 - 0.52 270 - 60	3.12 - 1.85 4.8 - 3.0		28 - 13 29 - 16
<u>Mediastinal Hodgkins</u>	1	1	1200	1900	6 x 8 7 x 8 8 x 14	4.56 2.09 2.76 - 0.570		7.6		3.8	
											1.805 - 0.9

## \*FACTORS:

Technique 1 --- 250 KV:  $\frac{1}{2}$  Cu 1 AL: TSD 50 CM  
 " 2 --- 120 KV: 3 AL: TSD 29 CM  
 " 3 --- 100 KV: No Filter: TSD 29 CM  
 " 4 --- 80 KV: No Filter: TSD 29 CM

C = COVERED

U = UNCOVERED

higher contribution by scatter from within the body.

As was expected, the dosage measurements in the larger phantom were less than in the smaller phantom when distant areas were treated. This has been demonstrated by Feldman *et al.* (3), using a Keleket pocket dosimeter.

## DISCUSSION

To evaluate the genetic hazards of any radiation procedure, it is necessary that the gonadal dosage be known. Webster *et al.* (4) noted a wide variation in gonadal exposure during diagnostic procedures as reported from several institutions. This would probably apply to the therapeutic

1. In the  
2. Only in  
3. The g  
4. Coveri  
5. The u  
6. In radi  
7. Instru

ranges a  
factors.

It is  
measure  
curate  
until b  
available  
of stra

TABLES III AND IV: GONADAL DOSES WITH RADIOTHERAPY OF EXTREMITIES, SPINE, AND ABDOMEN

## PROXIMAL UPPER EXTREMITY

LESION	No. Ports	Fac-tors*	DOSE (r)		Port Size	GONADAL DOSE IN ROENTGENS						
			Tumor			MALE			FEMALE			
			6 MOS.	6 YRS.		U 12 YRS.	C	6 MOS.	6 YRS.	U 12 YRS.	C	
Eosinophilic Granuloma	1	1	600	650	6x6	1.040		0.949	0.420			
				700	7x8			1.050		0.385		
				850	7x8			0.68 - 0.38		0.73 - 0.43		
Hemangioma	1	3	400	600	3x4	0	0.003	-	0.060	0.000	0.003	
Ewing's Sarcoma	1	1	3000	3300	6x6	5.280		4.620	2.145			
				3400	7x8			6.100		10.064	1.870	
				4100	7x8			3.28 - 1.85			3.49 - 2.05	
Metastatic Bone	1	1	1500	1650	6x6	2.640		2.310	1.072			
				1900	7x8			2.850		5.624	1.045	
				2000	7x8			1.6 - 0.9			1.8 - 1.0	

## PROXIMAL LOWER EXTREMITY

Eosinophilic Granuloma	1	1	600	700	6x6	28.0		6.720	2.100		
				800	7x8			14.4		8.32	1.920
				1000	8x8			16.32 - 10.0			5.12 - 2.48
Hemangioma	1	3	400	600	3x4	0.7	0.320	-	0.22 - 0.05	0.125	0.035
Ewing's Sarcoma	1	1	3000	3700	6x6	148			35.52	11.1	
				4050	7x8			72		41.6	9.6
				5100	8x8			83.2 - 51.0			26.11 - 12.65
Metastatic Bone	1	1	1500	1800	6x6	72.0			11.28 - 5.4		
				2030	7x8			36.0		20.8	4.8
				2600	8x8			42.43 - 26.0			13.31 - 6.45

## LUMBAR SPINE

Aneurysmal Bone Cyst	1	1	600	700	6x8	6x8	-	15.68	1.12	-	20.16	4.2
----------------------	---	---	-----	-----	-----	-----	---	-------	------	---	-------	-----

## ABDOMEN AND GENITALIA

LESION	No. Ports	Fac-tors*	DOSE (r)		Port Size	GONADAL DOSE IN ROENTGENS						
			Tumor			MALE			FEMALE			
			6 MOS.	6 YRS.		12 YRS.	C	6 MOS.	6 YRS.	12 YRS.	C	
Hemangioma Abdomen	1	3	400	600	3x4	0.480	0.31	-	0.600	0.48	-	
Hemangioma Genitalia	1	3	400	600	3x4	-	-	-	0.80	0.61	-	
Wilms Tumor	2	1	2500	3000	7x8	2.64			81.6 - 32.64			
				3300	10x10			7.65		36.96 - 13.2	-	
Neuroblastoma	2	1	1800	2100	7x8	18.48			57.12 - 22.85			
				2300	10x10			5.336		25.76 - 9.2	-	

## CONCLUSIONS

1. In the treatment of infants and children the gonadal dose does not approach the usual sterilizing dose in adults.
2. Only in the treatment of the proximal femur in the male and Wilms' and neuroblastoma in the female does the gonadal dose exceed 50.
3. The gonadal dose received from head and neck irradiation is insignificant.
4. Covering the gonads with 2mm of lead rubber reduces the gonadal dose by 40% to 90%.
5. The uncovered male gonad receives a significant amount of its total radiation from the tube housing.
6. In radiotherapy the ovary receives more radiation than the testicle with very few exceptions.
7. Instrumentation, proper positioning, and difficulty in reproducing body densities limit the accuracy of measurements.

ranges as well and would depend on many factors.

It is fully realized that the methods of measurement in this study are not as accurate as would be desired. However, until better recording instruments are available for measuring the small amount of stray radiation, these figures will give

a relative idea as to the dosage received. The chambers used by Baily *et al.* (5) overcame several of these problems.

It is difficult to construct a phantom corresponding exactly to the human body. This will be necessary before extremely accurate determinations of gonadal dosage can be made.

## SUMMARY

Phantoms of children aged six months, six years, and twelve years were constructed and irradiated under conditions simulating actual therapeutic procedures. The gonadal dosages received were measured by Victoreen No. 362 pocket dosimeters, which were checked against a 250-mr Victoreen chamber.

The dosages measured are recorded in a series of tables. More accurate measurements will have to await further refinement of the instrumentation.

## REFERENCES

1. POTTS, W. J.: *The Surgeon and the Child*. Philadelphia, W. B. Saunders Co., 1959.
2. RAVENTOS, A.: Should We Stop Treating Children With X-Rays (Editorial). *Pennsylvania M. J.* **59**: 1155-1156, September 1956.
3. FELDMAN, A., BABCOCK, G. C., LANIER, R. R., AND MORKOVIN, D.: Gonadal Exposure Dose from Diagnostic X-Ray Procedures. *Radiology* **71**: 197-207, August 1958.
4. WEBSTER, E. W., AND MERRILL, O. E.: Radiation Hazards; Measurements of Gonadal Dose in Radiographic Examinations. *New England J. Med.* **257**: 811-819, Oct. 24, 1957.
5. BAILY, N. A., YODER, V. E., AND BOZZINI, M. A.: Gonadal Dose in Radiation Therapy. *Radiology* **74**: 820-823, May 1960.

1100 West Michigan St.  
Indianapolis 7, Ind.

## SUMMARIO IN INTERLINGUA

## Dosage Gonadal in Radiotherapia Pediatric

Phantomas representante juveniles de sex menses, sex annos, e dece-duo annos de etate esseva construite e irradiate sub condicione simulant genuin manovras therapeutic. Le dosages gonadal recipite esseva mesurate per medio de dosimetros de tasca Victoreen No. 362 verificate a base de un camera Victoreen a 250 mr.

Le expositiones mesurate es colligite in un serie de tabulas. Le conclusiones general del studio es le sequentes:

1. In le tractamento de infantes e juveniles, le dose gonadal non approcha le usual dose sterilisante in adultos.
2. Le dose gonadal excede 50 r solmente in le tractamento del femore prox-

imal in masculos e de tumor de Wilms e neuroblastoma in le feminina.

3. Le dose gonadal recipite ab irradication de capite e collo es insignificative.

4. Coperir le gonades con 2 mm de cauchu a plumbo reduce le dose gonadal per inter 40 e 90 pro cento.

5. Le non coperite gonades masculine recipite un significative quantitate de su radiation total ab le concha del tubo.

6. Le ovarios—con pauchissime exceptiones—recipite plus radiation que le testes.

7. Le accuratia del mesuration es limitate per factores de instrumentation e del positionamento e per le difficultate de reproducer le densitates del corpore.



Pulm

RO

THE

diac

intensive

reac

tive

ful

oper

accu

anato

mandato

catheteri

have

pro

genogra

for

appr

because

congenit

monopat

accu

mali

the

silho

dividual

and

univ

the

pulm

pertensi

alteratio

scrib

called

a

aorta

in

throu

is

direct

ary

ve

adults

of

lesio

instabili

group

ha

Famil

of

the

they

ca

graphica

within

the

pos

tions

are

the

vei

arteries

useful

been

th

and

rev

From

cal

Society

## Pulmonary Veins in Congenital Heart Disease in the Adult<sup>1</sup>

ROBERT S. ORMOND, M.D., ANDREW K. POZNANSKI, M.D., and ARCH W. TEMPLETON, M.D.

THE ROENTGEN signs of congenital cardiac disease have been the subject of intensive study since the advent of corrective heart surgery. For the successful operative repair of cardiac defects, accurate preoperative evaluation of the anatomy and physiology of the heart is mandatory and for this purpose cardiac catheterization and angiography have proved decisive. The routine roentgenogram, however, remains the base line for appraisal of the cardiac patient and, because the usual lesion encountered in congenital heart disease in the adult is monopathic, the radiologist can be quite accurate in his prediction of the abnormality. Alterations in the configuration of the silhouette due to enlargement of individual chambers are well documented and universally used. The appearance of the pulmonary arteries in pulmonary hypertension, as well as in lesions leading to alterations in blood flow, have been described, and more recently Campbell has called attention to the appearance of the aorta in conditions leading to altered flow through that structure. The present study is directed to an analysis of the pulmonary veins in congenital heart disease in adults. Because of the great complexity of lesions encountered in infants and the instability of their physiologic state, that group has been excluded.

Familiarity with the position and course of the pulmonary veins is necessary before they can be distinguished roentgenographically from other vascular shadows within the lungs. Upright laminograms in the postero-anterior and oblique projections are of considerable aid in delineating the veins and separating them from the arteries. Magnification views are also useful. The anatomy of the veins has been thoroughly presented by Boyden and reviewed by Michelson and Salik.



Fig. 1. Superimposition of left atrium and major visible pulmonary veins upon heart and lung fields.

Figure 1 is a schematic superimposition of the major pulmonary veins upon the heart and lung fields.

Four major venous channels are constant in position and can usually be identified on routine postero-anterior films of the chest. They are: the posterior division of the superior pulmonary veins, the superior and inferior divisions of the inferior pulmonary veins, and the middle pulmonary veins. These vessels can be seen crossing the arterial channels and entering the left atrium below the main pulmonary arteries. Postero-anterior roentgenograms made in the 120- to 150-kv range are optimal in delineating veins.

Variation in vein size in normal patients is considerable, and in studying unselected patients one quickly appreciates that no absolute value can be ascribed to the diameter of a normal vein. With experience, the subjective impression of vein size obtained from scanning the individual film proves quite useful. In congenital heart disease the veins in the lower lung fields are better correlated with blood flow, while in acquired heart disease the

<sup>1</sup> From the Henry Ford Hospital, Detroit, Mich. Presented at the Forty-sixth Annual Meeting of the Radiological Society of North America, Cincinnati, Ohio, Dec. 4-9, 1960.

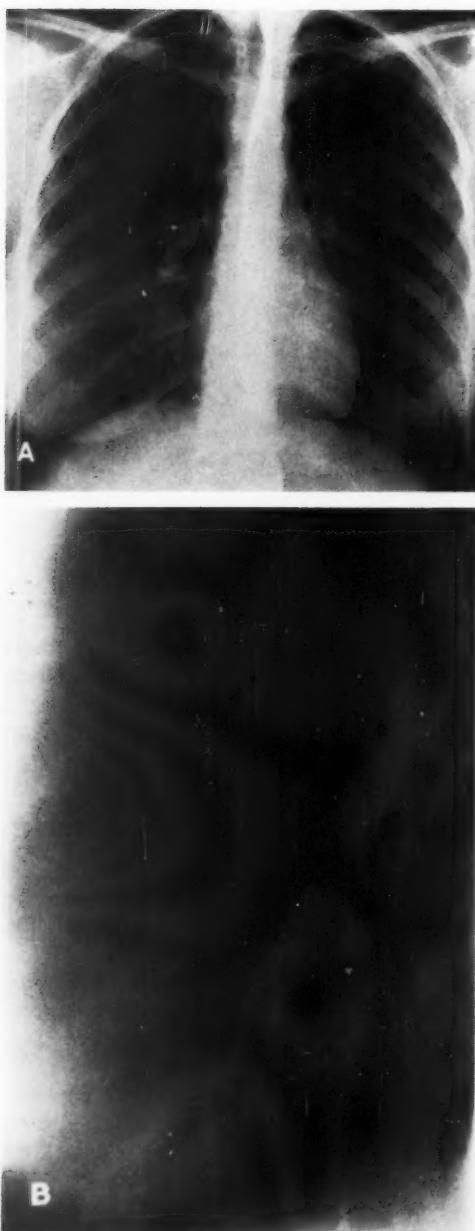


Fig. 2. Normal pulmonary venous vasculature in a 20-year-old woman studied for cardiac murmur. Normal findings on catheterization. A. Postero-anterior film. B. Upright laminogram.

upper lobe veins are better correlated with left atrial pressure. We have utilized a classification that separates the veins into

TABLE I: SUMMARY OF 86 CASES STUDIED

Patients in Group	Patients with Pulmonary Artery Pressure Greater than 40 mm. of Mercury	Patients with Balanced Shunt
Normal	6	
Pulmonic stenosis	22	
Interatrial septal defect	27	21
Interventricular septal defect	13	8
Patent ductus	18	10
<b>TOTAL</b>	<b>86</b>	<b>7</b>
Surgery or autopsy	43	
Angiography	10	

five categories: (1) definitely reduced; (2) reduced to normal; (3) normal; (4) normal to increased; (5) definitely increased. While this is admittedly a gross division and subject to inexactness, practically it is of value when the appearance of the veins is correlated with the arterial and cardiac configuration. Figure 2 is an example of normal venous vasculature as demonstrated on a postero-anterior film and laminogram.

#### MATERIAL

Eighty-six patients were included in this study. Right heart catheterization was done in all, with determination of intracardiac, pulmonary artery, and pulmonary wedge pressures. The oxygen saturation of the blood was determined at suitable levels in the heart and pulmonary artery. The Fick principle was utilized to determine output and volumes of shunt when present. Ten of the patients had undergone selective angiography and in 43 the lesions were confirmed at the time of corrective surgery or at autopsy. Table I presents the cases in summary.

**Pulmonary Stenosis:** In the 22 patients with pulmonary stenosis, the gradients across the valve varied from 7 to 176 mm. of mercury. In severe pulmonary stenosis with marked reduction in cardiac output the veins are slender and can be classed as definitely reduced; with less severe grades of stenosis and greater

3A

Fig. 3.  
A. Pos.  
artery and  
B. Lan.  
Fig. 4.  
A. Pos.  
B. Lan.  
cardiac  
veins is  
Intera...

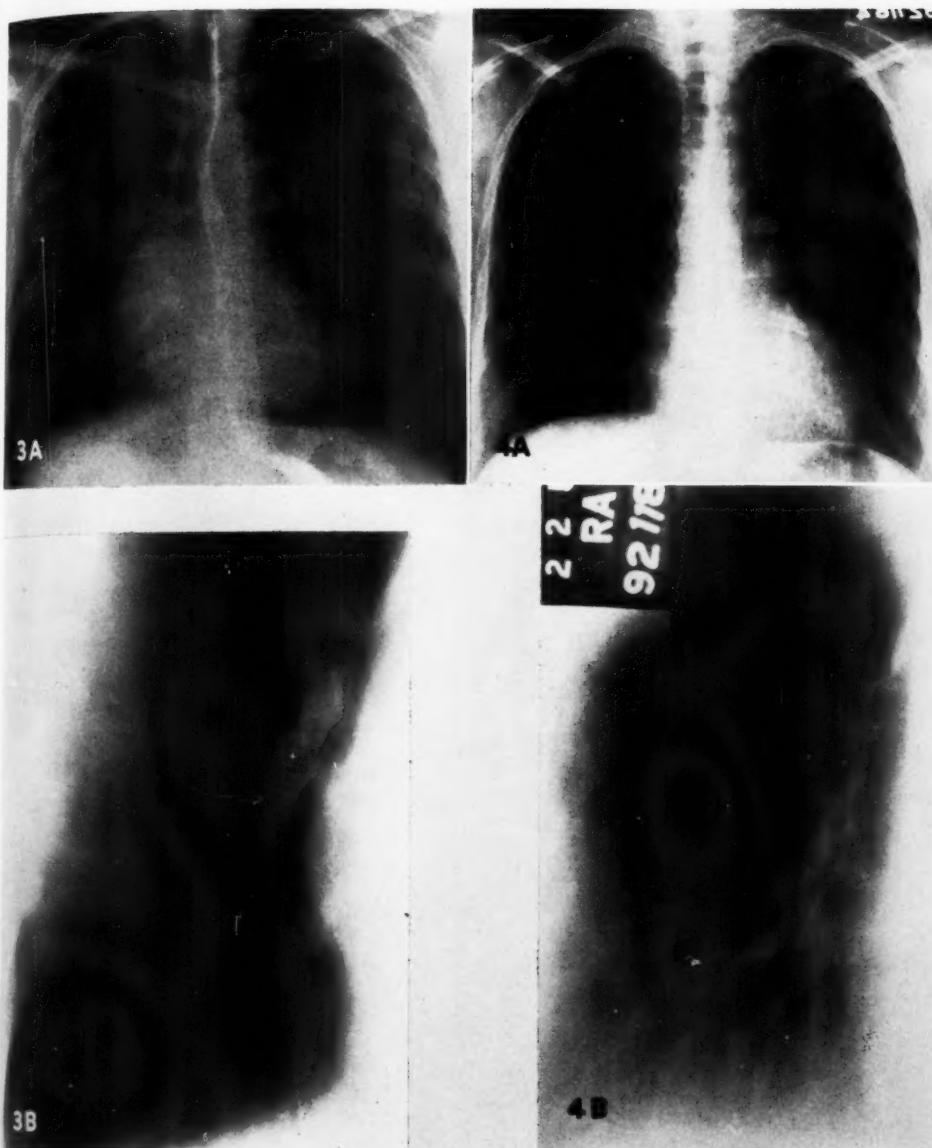


Fig. 3. Pulmonary stenosis in a 19-year-old male. Gradient across the valve 100 mm. of mercury.  
 A. Postero-anterior film, showing lucent lung fields and slender vessels. Note prominence of main pulmonary artery and left pulmonary artery.

B. Laminogram showing small slender venous channels.

Fig. 4. Pulmonary stenosis in a 29-year-old woman. Gradient of 15 mm. of mercury across pulmonary valve.  
 A. Postero-anterior film showing normal vessels; mild prominence of main pulmonary artery.

B. Laminograms showing small normal group of veins.

cardiac output the appearance of the veins is normal (Figs. 3 and 4).

*Interatrial Septal Defect:* Of the 27 patients with interatrial septal defects, 21

had pulmonary hypertension and 7 of these had pulmonary systolic pressures of 90 mm. of mercury or more. In uncomplicated interatrial septal defect the

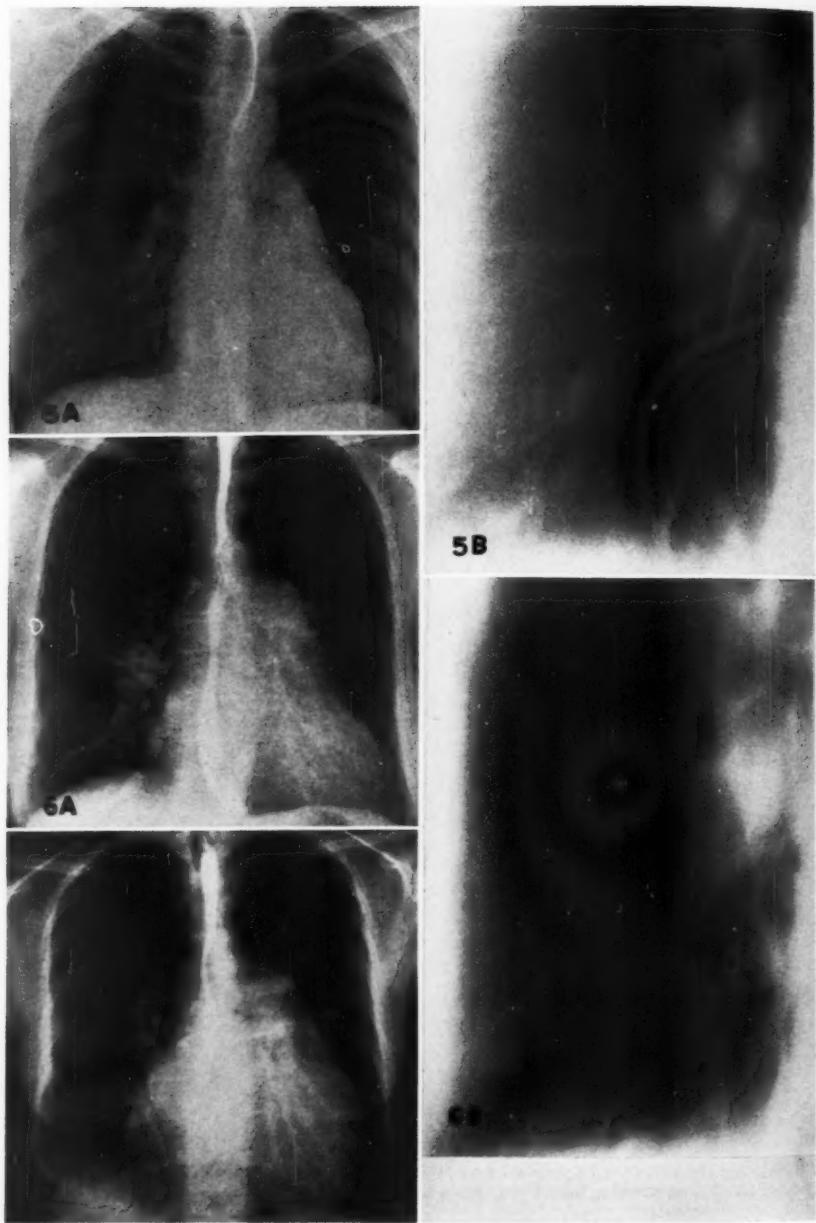


Fig. 5. Interatrial septal defect in a 40-year-old woman. Left-to-right shunt of 1.4 liters per minute. Pulmonary artery pressure 37/5 mm. of mercury.

A. Postero-anterior film showing prominent vasculature.

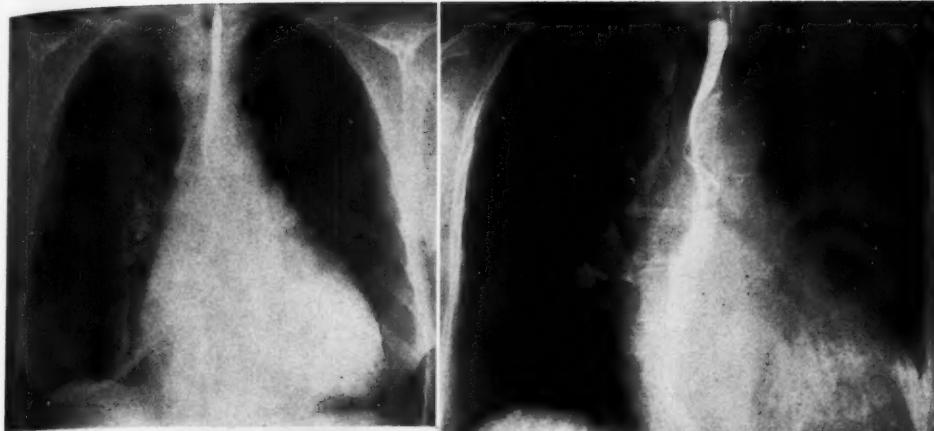
B. Laminogram showing large venous channels.

Fig. 6. Interatrial septal defect in a 54-year-old woman. Left-to-right shunt of 5.8 liters per minute. Mild pulmonary hypertension of 60/22 mm. of mercury in the pulmonary artery.

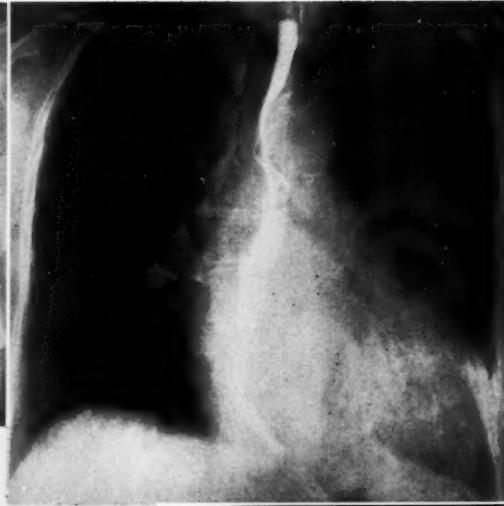
A. Postero-anterior film showing prominent venous channels and slender peripheral arteries.

B. Laminograms showing large venous channels.

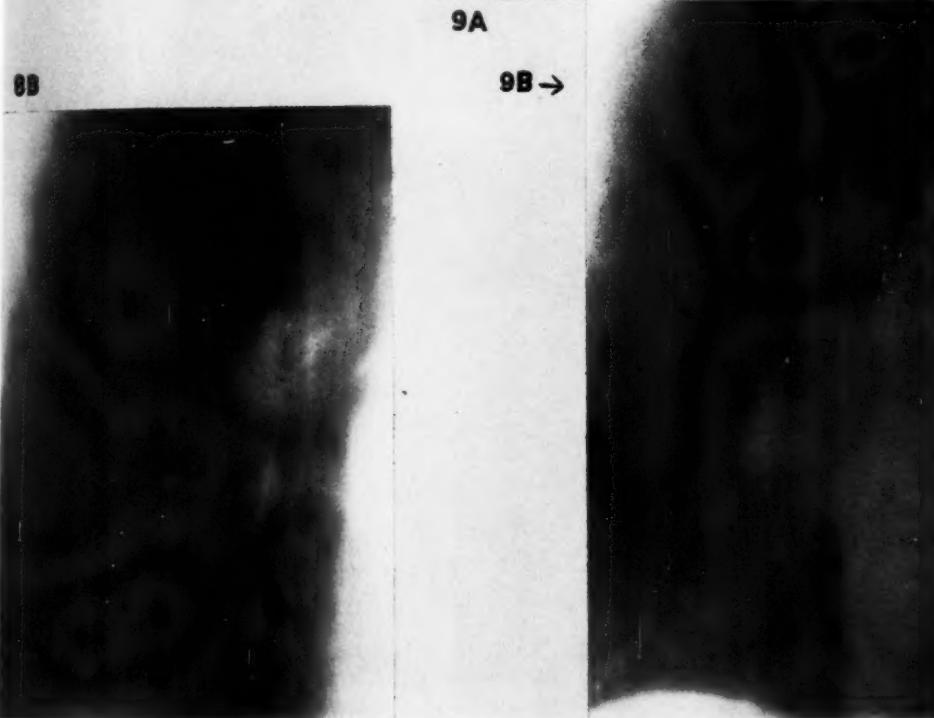
Fig. 7. Interatrial septal defect in a 42-year-old woman. Left-to-right shunt of 14.5 liters per minute. Pulmonary hypertension of 90/33 mm. of mercury in the pulmonary artery. Postero-anterior film showing large pulmonary venous channels lying horizontal in right lower lung field.



8A



9A



9B

9B →

Fig. 8. Patent ductus arteriosus in a 68-year-old woman. Left-to-right shunt of 1.8 liters per minute. Pulmonary artery pressure 34/17 mm. of mercury.

A. Postero-anterior film showing prominent vasculature.

B. Laminogram. The veins appear only slightly larger than normal.

Fig. 9. Patent ductus arteriosus with pulmonary hypertension in a 53-year-old woman. Left-to-right shunt of 11 liters per minute. Pulmonary artery pressure 64/33 mm. of mercury.

A. Postero-anterior film showing very prominent venous channels.

B. Laminogram. The root of the large vein only is seen on this cut.

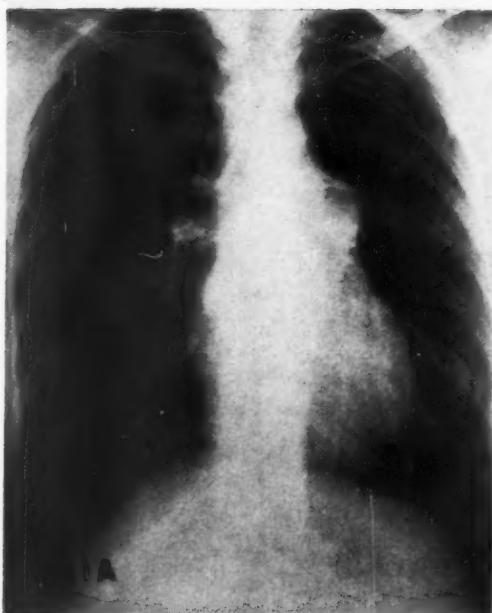
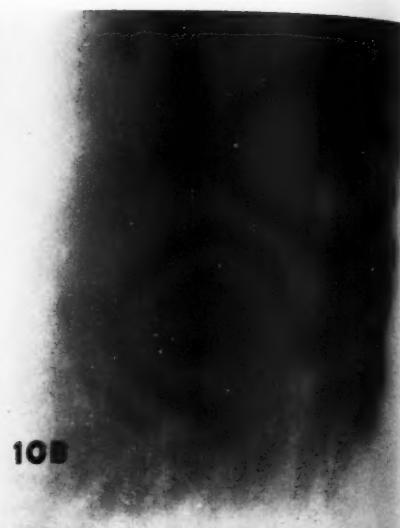
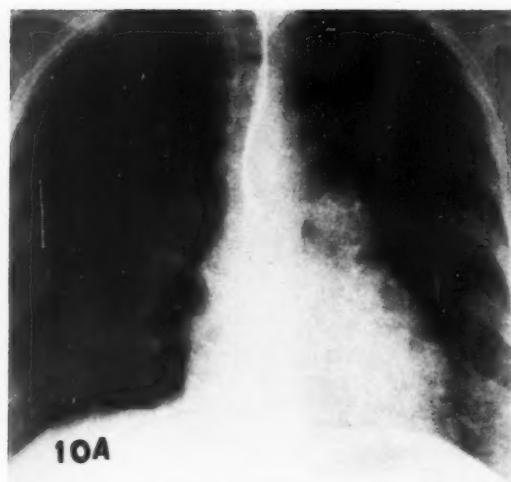


Fig. 10. Patent ductus arteriosus with intermittent reversal in a 25-year-old woman. Pulmonary artery pressure 125/65; aortic pressure 124/110.

- A. Postero-anterior film. The heart is large, the vessels of moderate size.
- B. Laminogram. The veins are of normal size.

Fig. 11. Patent ductus arteriosus with pulmonary hypertension in a 37-year-old woman. Minute shunt from right to left on angiography. Pulmonary artery pressure 110/50 mm. of mercury.

- A. Postero-anterior film. Note the similarity to pulmonary stenosis.
- B. Laminogram. The venous channels are small and normal.

Fig. 12.  
mm. of me  
A. Post  
B. Lam

size of the  
right ca  
veins are  
indeed,  
with the  
presence  
veins re  
cases a  
when t  
equaled  
(Fig. 7).

Patien  
tients w  
divided  
included  
patent  
pressure  
Group I  
patent d  
systolic  
but wi  
Pulmon  
was as  
the thi  
with ba



Fig. 12. Patent ductus arteriosus with reversal in an 18-year-old girl. Pulmonary artery pressure 100/65 mm. of mercury.

- A. Postero-anterior film.
- B. Laminagram. Note slender veins.

size of the shunt is reflected in an increased right cardiac output. The pulmonary veins are definitely increased in size; indeed, the largest veins are associated with this abnormality (Fig. 5). In the presence of pulmonary hypertension the veins remain large (Fig. 6). In all of our cases a left-to-right shunt persisted even when the pulmonary artery pressure equaled or exceeded the systemic pressure (Fig. 7).

**Patent Ductus Arteriosus:** The 18 patients with patent ductus arteriosus were divided into three groups. Group I included 8 patients with uncomplicated patent ductus with pulmonary systolic pressure below 40 mm. of mercury. Group II was comprised of 3 patients with patent ductus arteriosus with a pulmonary systolic pressure above 40 mm. of mercury but with persistent left-to-right shunt. Pulmonary artery pressure in this group was as high as 115 mm. of mercury. In the third group of 7 patients were those with balanced or reversed patent ductus

arteriosus. It is this third group which offers the greatest challenge to the cardiac physiologist. There is no typical appearance of the heart, and characteristic cardiac murmurs may be absent. The catheter data are often inconclusive, and angiography may fail to demonstrate a shunt. Surgery in the hypertensive group is contraindicated in the absence of significant left-to-right shunt.

The veins in uncomplicated patent ductus with left-to-right shunt are large (Fig. 8). The greater the shunt, the greater their size. The veins in those patients with pulmonary hypertension are large as long as a significant shunt persists (Fig. 9). In cases with a balanced or reversed shunt, the veins are smaller than in the other groups (Fig. 10); often they are smaller than those seen in normal patients and may indeed approach the size of veins in severe pulmonary stenosis (Figs. 11 and 12).

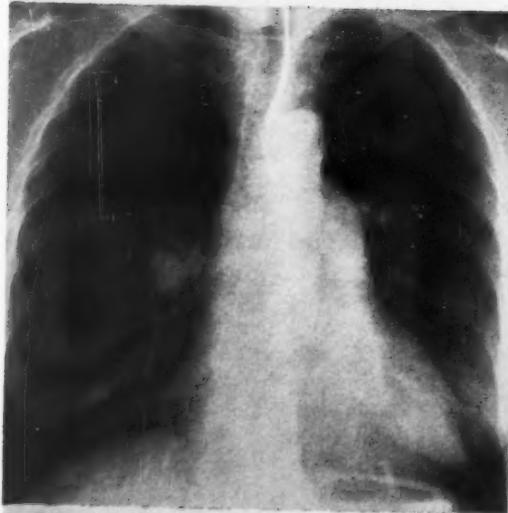
**Interventricular Septal Defect:** Thirteen patients in the group had interventricular



13A



13B



14



15

Fig. 13. Interventricular septal defect in a 44-year-old woman. Small shunt. Pulmonary artery pressure 30/7 mm. of mercury.

- A. Postero-anterior film showing normal vasculature.
- B. Laminogram.

Fig. 14. Interventricular septal defect in a 53-year-old woman. Shunt 7.3 liters per minute. Pulmonary artery pressure 29/11 mm. of mercury. Postero-anterior film showing increased vasculature.

Fig. 15. Interventricular septal defect with pulmonary hypertension in a 30-year-old woman. Shunt of 7.3 liters per minute. Pulmonary artery pressure 100/60 mm. of mercury. Postero-anterior film demonstrating large veins.

septal defects, and 8 of these had pulmonary hypertension. In 3 patients the ventricular pressure on the right was equal to that on the left. The pulmonary veins in the presence of small shunts were normal in size (Fig. 13); in patients with large shunts the veins were also large (Fig. 14). In the presence of pulmonary hypertension the veins are large as long as the shunt persists (Fig. 15).

In the few patients we have been able to study by catheterization and roentgenography before and after corrective surgery, there has been a reduction in vein size when successful repair has been obtained.

#### CONCLUSION

Pulmonary veins in congenital heart disease reflect the flow of blood through the lung fields. In those conditions which lead to an increase in flow, the veins are large. In lesions such as pulmonary stenosis and pulmonary hypertension, leading to shunt balance and reversal, in which the cardiac output is reduced, the veins are small. In patent ductus arteriosus, evaluation of the state of the pulmonary physiology can be made by comparing the size of the veins with the size and configuration of the arteries. In patients with pulmonary hypertension, a

successful surgical result depends upon the presence of a significant left-to-right shunt. Vein size offers one more method of evaluating the amount of such a shunt.

NOTE: The authors are indebted to Dr. Ellet Drake and Dr. Henry Gale, of the Adult Cardiology Department of the Henry Ford Hospital, for their aid in interpreting and making available the catheterization data.

The Henry Ford Hospital  
Detroit 2, Mich.

#### REFERENCES

- BOYDEN, E. A.: Segmental Anatomy of the Lungs. New York, The Blakiston Division, McGraw-Hill Book Company, 1955.
- CAMPBELL, J. A., AND KLATTE, E. C.: Radiology of Patent Ductus Arteriosus. Wisconsin M. J. **59**: 129-134, February 1960.
- FAIRLEY, G. H., AND GOODWIN, J. F.: Patent Ductus Arteriosus in Adult Life. Brit. J. Dis. Chest **53**: 263-277, July 1959.
- KLATTE, E. C., CAMPBELL, J. A., AND LURIE, P. R.: Aortic Configuration in Congenital Heart Disease. Radiology **74**: 555-566, April 1960.
- LODGE, T.: Anatomy of Blood Vessels of Human Lung as Applied to Chest Radiology. Brit. J. Radiol. **19**: 1-13, January; 77-87, February 1946.
- MICHELSON, E., AND SALIK, J. O.: The Vascular Pattern of the Lung as Seen on Routine and Tomographic Studies. Radiology **73**: 511-526, October 1959.
- ORMOND, R. S., AND POZNANSKI, A. K.: Pulmonary Veins in Rheumatic Heart Disease. Radiology **74**: 542-549, April 1960.
- STEINBACH, H. L., KEATS, T. E., AND SHELINE, G. E.: The Roentgen Appearance of the Pulmonary Veins in Heart Disease. Radiology **65**: 157-168, August 1955.

#### SUMMARIO IN INTERLINGUA

#### Venas Pulmonar in Congenite Morbo Cardiac del Adulto

Esseva studiate le venas pulmonar in 80 adultos con congenite morbo cardiac: 22 con stenosis pulmonar, 27 con defecto de septo interatrial, 13 con defecto interventricular, e 18 con patente ducto arterioso. Esseva etiam studiate sex pacientes con cordes normal. In 10 del casos, angiographia elective esseva effectuate, e in 43 le lesiones esseva confirmate al tempore del chirurgia corrective o del necropsia.

Esseva trovate que le venas pulmonar in congenite morbo cardiac reflecte le fluxo de sanguine a transverso le campos pulmonar. In le condicione que causa un augmento del fluxo, le venas es large. In lesiones del

tipo de stenosis pulmonar e de hypertension pulmonar que resulta in balanciamento del shunting e in reversion (e in que rendimento cardiac es reducite), le venas es micer. In patente ducto arterioso, le evalutation del stato del physiologia pulmonar pote esser facile per comparar le dimension del venas con le dimension e configuration del arterias. In pacientes con hypertension pulmonar, un successose resultat chirurgic depende del presentia de un significative derivation sinistro-dextere. Le dimension del venas pulmonar representa un criterio additional in le evalutation del quantitate de ille derivation.

# Total Anomalous Pulmonary Venous

## Drainage into the Portal System<sup>1</sup>

BERTRAM LEVIN, M.D.,<sup>2</sup> and HARVEY WHITE, M.D.<sup>3</sup>

MANY VARIATIONS of anomalous pulmonary venous drainage are known. Most of these are supradiaphragmatic, the veins emptying into the right side of the heart directly or *via* interposed vascular channels. These anomalies are generally compatible with life beyond infancy, dependent, of course, on associated defects of the heart and great vessels. Some of the anomalous venous connections can be suspected from the roentgen appearances because of characteristic contours of the heart and great vessels.

Pulmonary venous drainage into infradiaphragmatic vessels is far less common than the supradiaphragmatic type, comprising 10 to 20 per cent of all cases of total anomalous pulmonary venous drainage (2,6,8). With rare exceptions, the drainage is into the portal vein or ductus venosus and it is solely with these cases that this report is concerned. From the recorded examples, especially those of Johnson *et al.* (7), and from personal experience, it is evident that in this group also there is a characteristic roentgenographic appearance which permits accurate diagnosis. In this instance it is the pulmonary vascular pattern rather than the contour of the heart or great vessels which is distinctive. It is our intention here to correlate the abnormal physiology and pathologic anatomy with the roentgen findings in infradiaphragmatic pulmonary venous drainage. Four cases make up the subject material for this report. Three were proved at autopsy; the fourth was diagnosed by angiography.

### CASE REPORTS

CASE I: E. L., a 2-month-old white male infant, was admitted to Children's Memorial Hospital because of intermittent cyanosis since the age of three

days. The mother had suffered no illness during her pregnancy, and there was a normal two-year-old sibling. The patient had been born spontaneously at full-term.

The child had been kept under observation in the hospital and progressed reasonably well for about three weeks, when he was discharged in fair condition. The heart and abdominal organs were found to be reversed. In the interval between his discharge and admission to Children's Memorial Hospital, the mother noted increasing respiratory difficulty during the cyanotic episodes.

On admission the child was well nourished but pale, with slightly cyanotic lips and fingers. There was moderate tachypnea with no retractions while in oxygen. The pulse rate was 144 per minute. The lungs appeared clear. The maximum cardiac impulse was on the right. The liver edge was palpated on the left.

Roentgenograms of the chest confirmed the dextrocardia. The stomach was on the right. The lung fields showed a marked reticulated appearance (Fig. 1).

Angiography was performed through a catheter placed in the right ventricle. The aorta and pulmonary arteries filled promptly, apparently from a single ventricle. In the late phase of the angiogram the pulmonary veins were seen to fill; they formed a common trunk and, instead of entering the left auricle, passed below the diaphragm into the portal system (Fig. 2). A biopsy of the lung was performed.

The child was discharged from the hospital and died at home a few weeks later. No autopsy was obtained.

CASE II: B. M., a 12-day-old white male infant, was brought to the Children's Memorial Hospital with a history of cyanosis and respiratory distress since shortly after birth. The delivery was normal and the child weighed 8 lbs. 4 oz. He had to be kept in oxygen continuously but took his feedings well.

On admission the infant was well developed and well nourished but in obvious respiratory distress. Fine râles were heard throughout both lung fields. Roentgenograms revealed normal cardiac size and contour and a fine reticulated appearance throughout both lung fields, extending to the periphery (Fig. 3). After about one week in the hospital the baby improved slightly and then suffered an episode of paroxysmal dyspnea lasting three hours. This

<sup>1</sup> Accepted for publication in November 1960.

<sup>2</sup> Director, Department of Diagnostic Roentgenology, Michael Reese Hospital and Medical Center, Chicago, Ill.

<sup>3</sup> Director, Radiology Department, Children's Memorial Hospital, Chicago, Ill.

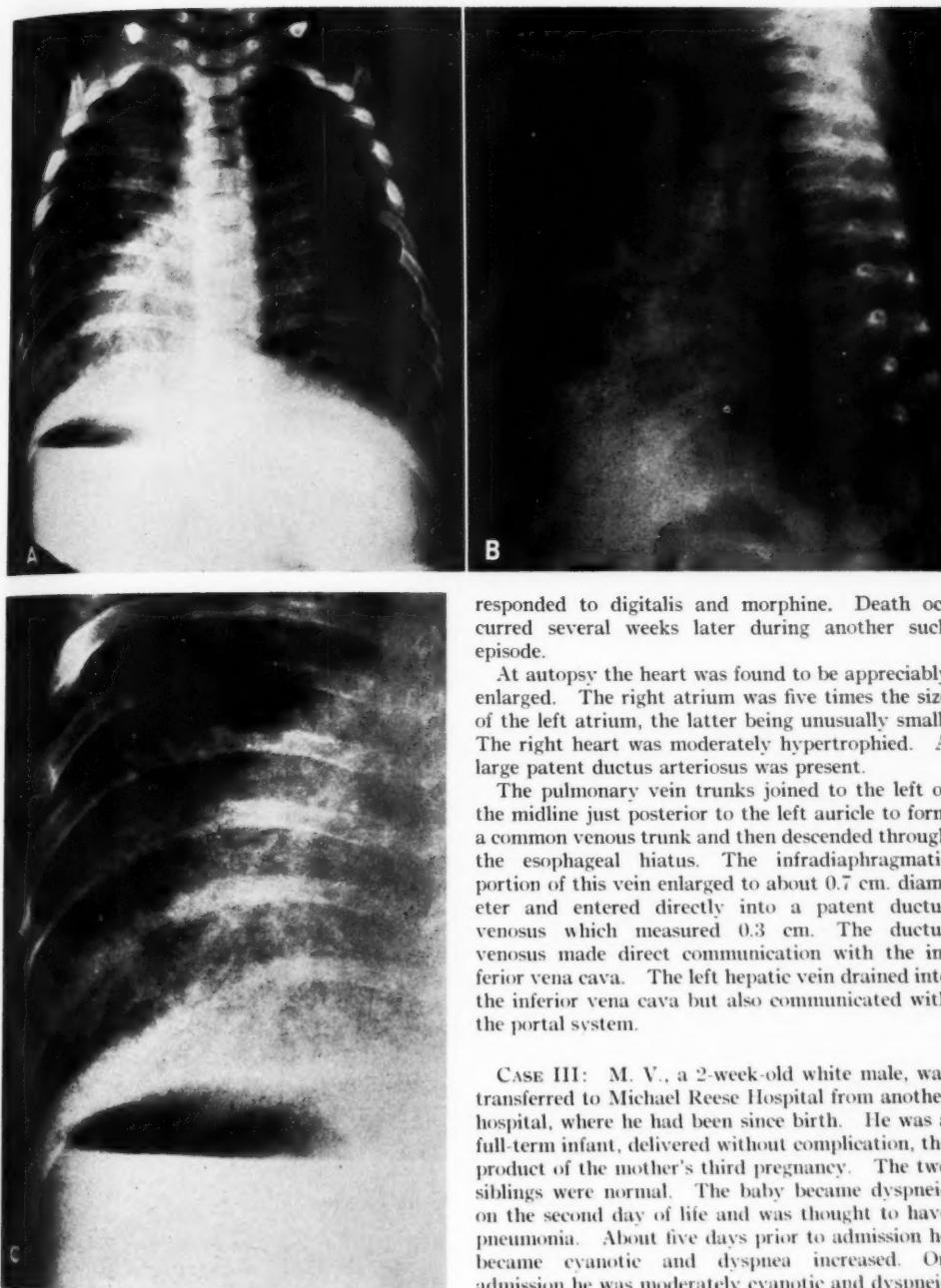


Fig. 1. Case I. A and B, showing dextrocardia and situs inversus. The heart is of normal size. There is a prominent reticular appearance throughout both lung fields.

C. Magnified view of the right lower lung field showing the reticular pattern. On the original roentgenogram faint but definite Kerley lines were evident.

responded to digitalis and morphine. Death occurred several weeks later during another such episode.

At autopsy the heart was found to be appreciably enlarged. The right atrium was five times the size of the left atrium, the latter being unusually small. The right heart was moderately hypertrophied. A large patent ductus arteriosus was present.

The pulmonary vein trunks joined to the left of the midline just posterior to the left auricle to form a common venous trunk and then descended through the esophageal hiatus. The infradiaphragmatic portion of this vein enlarged to about 0.7 cm. diameter and entered directly into a patent ductus venosus which measured 0.3 cm. The ductus venosus made direct communication with the inferior vena cava. The left hepatic vein drained into the inferior vena cava but also communicated with the portal system.

**CASE III:** M. V., a 2-week-old white male, was transferred to Michael Reese Hospital from another hospital, where he had been since birth. He was a full-term infant, delivered without complication, the product of the mother's third pregnancy. The two siblings were normal. The baby became dyspneic on the second day of life and was thought to have pneumonia. About five days prior to admission he became cyanotic and dyspnea increased. On admission he was moderately cyanotic and dyspneic with subcostal retraction. The heart rate was regular, 180 per minute; the heart size was normal. There was a grade III systolic murmur best heard along the left sternal angle in the third, fourth, and fifth interspaces, easily audible up and down the sternum and over the back. The electrocardio-

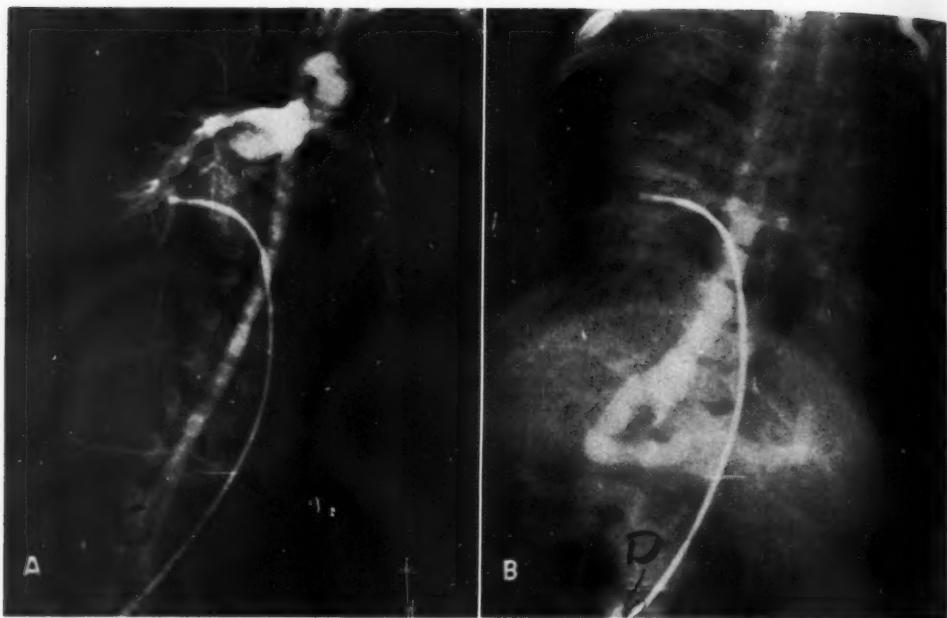


Fig. 2. Case I. Angiocardiograms. A. With the catheter in the right ventricle, there is simultaneous filling of the pulmonary artery and aorta, probably due to a high ventricular septal defect.

B. The pulmonary veins join to form a common trunk which descends through the diaphragm to drain into the portal vein.

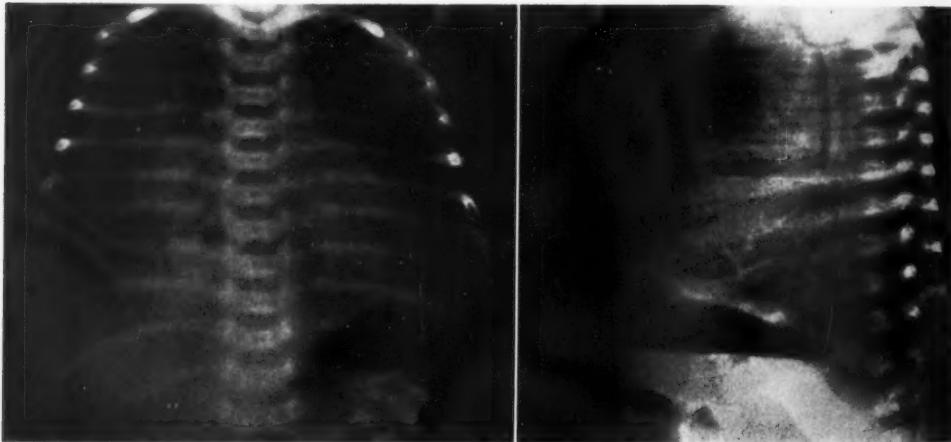


Fig. 3. Case II. Heart size and contour within normal limits. The reticulated appearance of both lung fields is evident in the lateral as well as in the frontal projection.

gram showed clear evidence of right heart strain and congenital heart disease. An attempt at angiography was technically unsuccessful. In spite of supportive treatment the child became increasingly cyanotic, even in oxygen, and died at the age of two months. A number of chest roentgenograms revealed the heart size and contour to be within normal limits. There was a very prominent

reticulated appearance throughout the lung fields, and dilatation of interlobar lymphatics was apparent in the lung bases. These changes were best evident in the lateral projection (Fig. 4).

Postmortem examination showed the heart to be normal in shape but somewhat dilated. The right ventricle was moderately enlarged and dilated. The superior and inferior venae cavae opened into it.

The foramen across. The pulmonary veins gave off right widely patent. The mitral valve was small. The left ventricle was normal. The aortic arch was

The broad lungs in the was found to be very small. The main pulmonary vein from the right within the pulmonary lung parenchyma veins opened caudally. The special hilum of the diaphragm, the portal vein, the superior mesenteric. Thus, oxygen

through the and the atrium, oxygenated from the again entering through

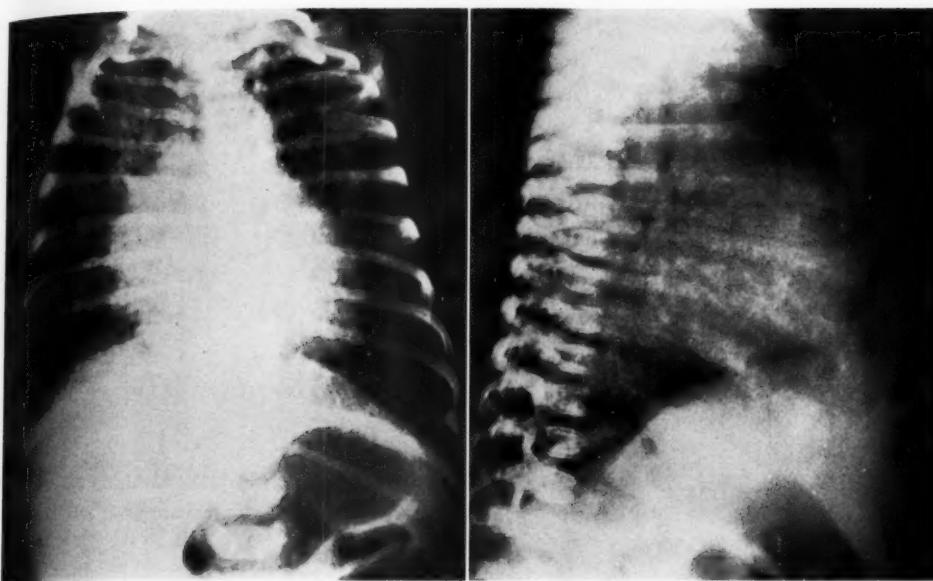


Fig. 4. Case III. In both views the prominence of the pulmonary markings is evident. The heart appears slightly enlarged.

The foramen ovale was patent and measured 1 cm. across. The tricuspid valve was normal. The pulmonary artery arose from the right ventricle and gave off right and left pulmonary arteries as well as a widely patent ductus arteriosus. The left atrium was small; it did not receive any pulmonary veins. The mitral valve was tender and delicate. The left ventricle was small; from it the aorta emerged in normal position. There was no narrowing of the aortic arch.

The bronchi and pulmonary arteries entered the lungs in normal fashion. A large pulmonary vein was found in each hilar region. On the right side a very small vein extended outside the lung from the main pulmonary vein to the apical region. The vein from the upper and middle lobe branched off within the lung itself. On the left side was a large pulmonary vein which also branched off within the lung parenchyma. The right and left pulmonary veins opened into a common trunk which extended caudally and passed through the diaphragm *via* a special hiatus in the medial aspect of the left hemidiaphragm. Below the diaphragm this vein entered the portal vein which also received splenic and superior mesenteric veins and a small gastric vein. Thus, oxygenated blood from the lungs coursed through the portal vein, the liver, the hepatic vein, and the inferior vena cava, and entered the right atrium, whence part of it reached the left atrium through the foramen ovale. Another portion of oxygenated blood reached the right ventricle and from there went into the pulmonary artery, where it again entered either the lungs or the greater circulation through the ductus arteriosus.

**CASE IV:** J. D., a white male infant, was a twin born at full term with a normal brother, following an apparently normal pregnancy. His birth weight was 4 lb. 11 oz. He was kept in an incubator for one day and was in the hospital for two weeks following birth. His weight at the time of discharge was 4 lb. 12 oz. From birth he was pale and lethargic. He took feedings poorly and occasionally his lips became slightly blue. At times he appeared to be in mild respiratory distress.

At the age of one month the child was admitted to the Children's Memorial Hospital. He was pale but not cyanotic, except possibly very slightly so when crying. A xiphoid impulse was palpable. There were no thrills. Tachycardia and tachypnea were present. The first heart sound was normal; the second was widely split and fixed. A short grade I-II systolic murmur was heard best at the mid-left sternal border. There was no diastolic murmur. The liver was palpable 2 cm. below the right costal margin. The spleen was not palpable. The femoral pulses were normal. There was slight pitting edema of the legs. Chest films revealed marked reticulation of the lung fields (Fig. 5). The heart was not significantly enlarged. Because of the characteristic roentgenographic appearance, the diagnosis of infradiaphragmatic pulmonary venous drainage was made.

A few days after admission there was an episode of apnea during feeding, lasting about fifteen seconds. On the next day the patient again experienced apnea associated with a large emesis of milk. He died moments later.

Postmortem examination showed the heart to be

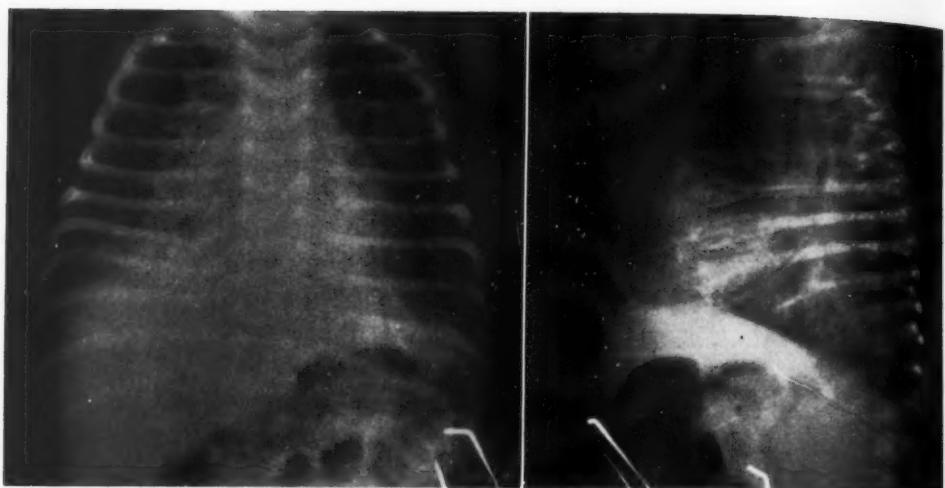


Fig. 5. Case IV. The normal heart size and prominent reticulated lung pattern are again evident.



Fig. 6. Case IV. Autopsy specimen showing the pulmonary venous trunk (a) and its entry into the portal vein (b).

of normal size or minimally enlarged. The wall of the right atrium was thickened. The foramen ovale was patent (0.2 cm.). The tricuspid valve was slightly deformed, the inferior leaflet having an aberrant chorda going to the septum. The right ventricle was questionably enlarged, and its wall considerably thickened. The aorta and pulmonary arteries were normal, as were the venae cavae. The ductus arteriosus was patent.

The left atrium was small and thin-walled. The left ventricle was somewhat smaller than normal and its wall also was thin. The ventricular septum was intact. The transverse aorta was distinctly narrower than the ascending aorta.

In the midline directly behind the heart, the left superior and inferior pulmonary veins joined a large vein, into which the right superior and inferior pulmonary veins likewise emptied. All four veins joined the large vein independently. This central vein had a blind end, just above the point at which the superior pulmonary veins drained into it. After receiving the four pulmonary veins, it passed downward in the midline and pierced the diaphragm just anterior to the esophagus. It did not follow the lesser curvature of the stomach but took a straight downward course slightly to the right, to a point just behind the neck of the pancreas. Here the portal vein was formed by the union of the splenic, inferior mesenteric, and superior mesenteric veins. The large vein from the thorax thus joined the portal vein at the point of its formation (Fig. 6). The portal vein was much enlarged as a result of its union with the large vessel transporting the pulmonary venous return but, apart from this, appeared entirely normal in its course and distribution. The inferior vena cava was formed in the usual way. Ultimately the pulmonary venous return emptied into the inferior vena cava by way of the hepatic veins, after having passed through the liver. There was no evidence of a persistent sinus venosus. The thoracic and abdominal aorta appeared normal.

#### PATHOLOGY

It is not within the scope of this paper to enter into a discussion of the embryology of the pulmonary circulation and the

aberration  
matic pul-  
reader is  
Brody (2)  
for these i  
As woul  
direct retu  
the left si  
normal. 1  
days there  
or of the  
permit blo  
lation. T  
are hyper  
As noted  
remarkabl  
largetmen  
anomalous

Increase  
is reflecte  
vessels, ed  
In addition  
due to  
lymphatic  
septa.

The al  
with vary  
granules.  
thickened  
monary a  
fibrosis; i  
often vary  
arterioscl  
excess of  
In addition  
the subple  
(Fig. 7).

These  
same as  
venous b  
stenosis.  
vascular  
and the  
are of gre  
of the du  
obstructi

It is to  
were mal  
ous repo

aberrations which lead to infradiaphragmatic pulmonary venous drainage. The reader is referred to the publications of Brody (2), Neill (10), and Edwards (4) for these interesting considerations.

As would be expected where there is no direct return of blood to the left atrium, the left side of the heart is smaller than normal. In patients living beyond a few days there is patency of the foramen ovale or of the ductus arteriosus, or both, to permit blood to reach the systemic circulation. The right atrium and ventricle are hypertrophied and usually dilated. As noted by Darling *et al.* (3), there is remarkably less right-sided cardiac enlargement than with supradiaphragmatic anomalous pulmonary venous drainage.

Increased circulation through the lungs is reflected in dilatation of pulmonary vessels, edema, and brownish discoloration. In addition, there is distinct lobulation due to dilatation of the interlobular lymphatics and edema of the interlobular septa.

The alveoli contain phagocytic cells with varying amounts of blood pigment granules. The alveolar walls are generally thickened. The larger vessels of the pulmonary arteries show distinct perivascular fibrosis; in the smaller branches there are often varying degrees of intimal thickening (arteriosclerosis). Reticulum stains show excess of reticulum in perivascular regions. In addition, there is distinct dilatation of the subpleural and interlobular lymphatics (Fig. 7).

These changes are qualitatively the same as those encountered in pulmonary venous hypertension as seen in mitral stenosis. In the latter cases the perivascular fibrosis, the intimal thickening, and the perivascular reticulum deposits are of greater degree, presumably because of the duration of the pulmonary venous obstruction.

#### DISCUSSION

It is to be noted that all 4 of our patients were male. This is in keeping with previous reports (3, 7), indicating the pre-

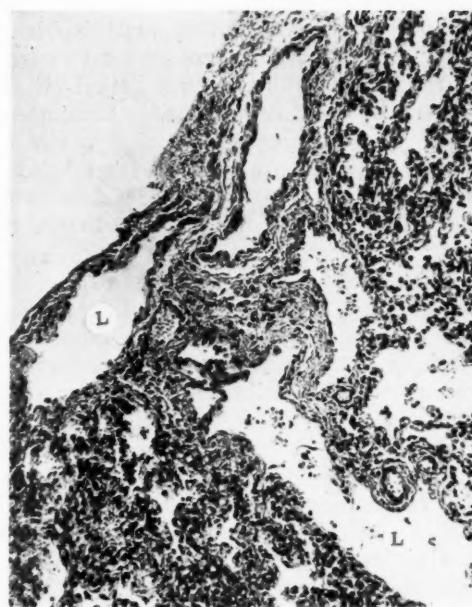


Fig. 7. Photomicrograph of lung section (Case III) showing dilatation of interlobular and subpleural lymphatics (L). ( $\times c. 75$ . Hematoxylin and eosin)

ponderance of males among those with infradiaphragmatic pulmonary venous drainage. Of the 24 cases reported, including those in the present series, 19 were in males, 4 in females, and in 1 the sex was not mentioned.

Though the course of the common pulmonary venous trunk through the diaphragm is in close relationship to the esophagus, a pressure effect on the esophagus was not observed in the present series nor has it been reported by others.

It is evident that the roentgen appearance of the lung fields is strikingly similar in the cases presented here and that it differs from that in other types of congenital heart disease. The pulmonary markings are prominent, with a distinctly mottled and reticulated appearance. In the lung bases Kerley lines may be identified with varying degrees of clarity. They are often more apparent in the lateral view than in the frontal. The pattern is appreciably different from that of increased vascularity seen in infants with pulmonary congestion due to heart failure

or to large left-to-right shunts. Neither the hilar nor branch pulmonary arteries are unusually wide nor can their arborization pattern be identified. Also, in the latter cases the prominence of the vascular pattern is less marked in the lateral than in the frontal views; in the cases described here the reverse is often true. In the 3 cases of infradiaphragmatic pulmonary drainage reported by Darling *et al.* (3), though little mention is made of the roentgen appearance of the chest, the summarizing table indicates less "pulmonary vascular congestion" than in their cases of supradiaphragmatic anomalous return.

It is of interest that cardiac size and configuration are not appreciably altered on the chest roentgenogram. They are, in fact, most often within normal limits. In this respect, too, infradiaphragmatic pulmonary venous drainage differs from supradiaphragmatic anomalous drainage and from other congenital cardiovascular diseases with pulmonary vascular engorgement.

The appearance of the lung fields is much like that seen in adults with pulmonary venous hypertension due to mitral stenosis or mitral insufficiency, except that in such cases there is prominence of the pulmonary arterial tree. A common finding in chronic sustained pulmonary venous hypertension (as seen in mitral valve disease) is the presence of Kerley lines in the lung bases (14). These transverse lines, a few millimeters to 2 cm. in length, extend to the pleura and are arranged in stepladder fashion. In mitral valve disease they represent dilatation of the interlobular lymphatics and/or edema fluid in the interlobular septa. When the pulmonary vein pressure is elevated and approaches osmotic pressure, transudation into the interlobular septa and lymphatics takes place. With reduction of the pulmonary venous pressure by mitral valvotomy, the Kerley lines generally disappear or become less distinct (9). In mitral valve disease the mechanics involved are quite evident—mitral valve

obstruction causes increase in pulmonary venous pressure.

The lung changes associated with pulmonary venous drainage into the portal vein can be as readily explained. Edwards and DuShane (5) attributed them to the obstruction caused by the minute caliber of the ductus venosus in those cases where the pulmonary veins enter as a common trunk into that vessel. Parsons *et al.* (12) concurred in this view. No explanation is offered for those cases in which the pulmonary vein trunk enters directly into the portal vein, a condition existing in 3 of our cases and in most cases of infradiaphragmatic pulmonary venous drainage reported in the past. We agree with Sherman and Bauersfeld (15) that the explanation is apparent from the anatomic and physiologic studies of the normal fetal circulation.

During fetal life the lungs do not function, the fetus receiving oxygenated blood from the placenta by way of the umbilical veins. These veins then pass through the liver and join the inferior vena cava via the ductus venosus. Most of the inferior vena caval blood entering the right auricle is shunted to the left auricle through the foramen ovale, meeting the venous blood returning from the lungs.

The portal vein pressure undoubtedly reflects the umbilical vein pressure, which in the human fetus is known to be from 30 to 50 mm. Hg (1, 11, 13). Thus, when the pulmonary venous blood enters the portal system, it encounters an obstruction due to the high pressure; the normal pulmonary venous pressure is only 10 mm. Hg. This portal pressure immediately increases the pulmonary venous pressure, readily accounting for the clinical manifestations and the roentgenographic appearance. One does not have to invoke the possibility of differences in caliber of vessels. The anomaly does not cause intrauterine death, since in the fetus there is no dependence on the lungs for blood oxygenation, the placenta acting as oxygenator. With the demands made on the

pulmonary ever, there hastened b sus.

It is app the anomalous to surgical that the p through the planted in ability make ease impera have found side of the (15). Thus chambers volume of surgical co vestigators monary ve dilated th degrees of smooth-mu "the anato crease the anastomos

Four ca monary ve into the c portal vei roentgenog enlarged h latel appe the antem the chest f ies—pre- a hypertensi

Michael Rees

Chicago 16, I

pulmonary circulation after birth, however, there is rapid onset of heart failure, hastened by closing of the ductus arteriosus.

It is apparent from the pathology that the anomaly is one that might be amenable to surgical correction. It would appear that the pulmonary trunk which descends through the diaphragm could be transplanted into the left auricle. This possibility makes early recognition of the disease imperative. Sherman and Bauersfeld have found that in such cases the small left side of the heart is atrophic, not aplastic (15). Thus one would expect that these chambers could adapt to an increased volume of blood which would result from surgical correction. However, these investigators also note that the large pulmonary venous trunk in this anomaly is a dilated thin-walled channel with varying degrees of scarring, often with incomplete smooth-muscle coats. They caution that "the anatomy of these channels may increase the hazard of thrombosis in venous anastomoses."

#### SUMMARY

Four cases of infradiaphragmatic pulmonary venous drainage are presented, 1 into the ductus venosus and 3 into the portal vein. In each instance the chest roentgenograms revealed a small or slightly enlarged heart and a characteristic reticulated appearance of the lungs. In 2 cases the antemortem diagnosis was made from the chest films. The altered hemodynamics—pre- and postnatal pulmonary venous hypertension—which cause the roentgen appearance are discussed.

Michael Reese Hospital  
Chicago 16, Ill.

#### REFERENCES

1. BARCLAY, A. E., FRANKLIN, K. J., AND PRICHARD, M. M. L.: The Foetal Circulation and Cardiovascular System, and the Changes That They Undergo at Birth. Springfield, Ill., Charles C Thomas, 1944.
2. BRODY, H.: Drainage of the Pulmonary Veins into the Right Side of the Heart. *Arch. Path.* **33**: 221-240, February 1942.
3. DARLING, R. C., ROTHNEY, W. B., AND CRAIG, J. M.: Total Pulmonary Venous Drainage into the Right Side of the Heart: Report of 17 Autopsied Cases Not Associated with Other Major Cardiovascular Anomalies. *Lab. Invest.* **6**: 44-64, January-February 1957.
4. EDWARDS, J. E.: Symposium on Anomalous Pulmonary Venous Connection (Drainage): Pathologic and Developmental Considerations in Anomalous Pulmonary Venous Connection. *Proc. Staff Meet. Mayo Clin.* **28**: 441-452, Aug. 26, 1953.
5. EDWARDS, J. E., AND DU SHANE, J. W.: Thoracic Venous Anomalies. *Arch. Path.* **49**: 517-537, May 1950.
6. HEALEY, J. E., JR.: An Anatomic Survey of Anomalous Pulmonary Veins: Their Clinical Significance. *J. Thoracic Surg.* **23**: 433-444, May 1952.
7. JOHNSON, A. L., WIGLESWORTH, F. W., DUNBAR, J. S., SIDDOO, S., AND GRAJO, M.: Infradiaphragmatic Total Anomalous Pulmonary Venous Connection. *Circulation* **17**: 340-347, March 1958.
8. KEITH, J. D., ROWE, R. D., VLAD, P., AND O'HANLEY, J. H.: Complete Anomalous Pulmonary Venous Drainage. *Am. J. Med.* **16**: 23-38, January 1954.
9. LEVIN, B.: On the Recognition and Significance of Pleural Lymphatic Dilatation. *Am. Heart J.* **49**: 521-537, April 1955.
10. NEILL, C. A.: Development of the Pulmonary Veins with Reference to the Embryology of Anomalies of Pulmonary Venous Return. *Pediatrics* **18**: 880-887, December 1956.
11. NYBERG, R., AND WESTIN, B.: On the Influence of Uterine Contractions on the Blood Pressure in the Umbilical Vein at Birth. *Acta paediat.* **47**: 350-353, July 1958.
12. PARSONS, H. G., PURDY, A., AND JESSUP, B.: Anomalies of the Pulmonary Veins and Their Surgical Significance: Report of 3 Cases of Total Anomalous Pulmonary Venous Return. *Pediatrics* **9**: 152-165, February 1952.
13. REYNOLDS, S. R. M., AND PAUL, W. M.: Pressures in Umbilical Arteries and Veins of the Fetal Lamb in Utero. *Am. J. Physiol.* **193**: 257-259, May 1958.
14. SHANKS, S. C., AND KERLEY, P., eds.: A Text-Book of X-Ray Diagnosis by British Authors. Philadelphia, W. B. Saunders Co., Vol. 2, 1950.
15. SHERMAN, F. E., AND BAUERSFELD, S. R.: Total, Uncomplicated, Anomalous Pulmonary Venous Connection; Morphologic Observations on 13 Necropsy Specimens from Infants. *Pediatrics* **25**: 658-668, April 1960.

(*Pro le summario in interlingua, riveder le pagina sequente*)

## SUMMARIO IN INTERLINGUA

## Anormal Total Drainage del Vena Pulmonar ad in le Systema Portal

Drainage del vena pulmonar ad in vasos infradiaphragmatic, usualmente le vena portal o le ducto venose, es multo minus commun que le drainage anormal supradiaphragmatic. Es presentate quattro casos: 1 con drainage ad in le ducto venose, 3 con drainage ad in le vena portal. In omne iste casos, le roentgenogrammas thoracic revelava un micre o levemente

allargate corde e presentava un characteristicamente reticulare apparentia del pulmones. In 2 casos, le diagnos esseva facile ante morte ab le film thoracic. In le altere casos, necropsias esseva effectuate. Es discutite le alterate hemodynamica, i.e. le hypertension pulmono-venose pre- e postnatal que es le causa del apparentia roentgenographic.



Radiolo

MANY  
been  
tion of di  
the esoph  
in an effo  
herniation  
gen exam  
sulting co  
recognize  
cannot be  
visualized

On the  
right ant  
patient 1  
phragm is  
ing to a  
leaf and  
indicates  
hiatus.  
visualize  
in relati  
at some  
the cross  
outlined  
silhouett  
tures in  
other in  
leaf of  
to cros  
obscure  
The hia  
tissue in  
in the  
be brou  
The im  
by conv  
been en  
It has  
alization  
ite bor  
hiatus,  
usually  
left lea

<sup>1</sup> From  
The Mo

<sup>2</sup> Train

## Radiologic Localization of the Esophageal Hiatus as Determined by Intraluminal Pressure Measurements<sup>1</sup>

BERNARD S. WOLF, M.D., and BERNARD R. COHEN, M.D.<sup>2</sup>

MANY DIFFERENT interpretations have been given of the nature and location of dilated segments in the region of the esophageal hiatus of the diaphragm in an effort to distinguish minimal hiatal herniation from the normal state by roentgen examination (1-4). Much of the resulting confusion has been due to failure to recognize that the position of the hiatus cannot be predicted by the level of the visualized portions of the diaphragm.

On the film taken in the conventional right anterior oblique position with the patient prone, the left leaf of the diaphragm is usually well seen and it is tempting to assume that the place where this leaf and the barium-filled esophagus cross indicates the position of the esophageal hiatus. This, however, is incorrect. The visualized portion of the diaphragm lies in relationship to the lung, behind and at some distance from the hiatus. When the crossing diaphragmatic leaf is sharply outlined, this can only be the result of the silhouette phenomenon, that is, the structures must lie in different planes. In other instances, the outline of the left leaf of the diaphragm where it appears to cross the esophagogastric region is obscured and not sharply delineated. The hiatus itself is filled with connective tissue continuous with the soft tissues in the posterior mediastinum and cannot be brought into profile by contrasting lung. The impossibility of locating the hiatus by conventional roentgen examination has been emphasized by several authors (5-8). It has been clearly demonstrated by visualization of opaque markers applied to its borders at laparotomy (5-7) that the hiatus, in the right anterior oblique view, is usually *above* the visualized portion of the left leaf of the diaphragm.

Under normal circumstances, the appearance of the esophagogastric region with the patient in the right anterior oblique position, drinking fluid barium, is quite constant and reproducible. A distensible region ("phrenic ampulla") clearly above the diaphragm is joined to the fundus of the stomach by a somewhat elongated, narrow segment ("empty segment," "junctional segment"). In deep inspiration, the junctional segment is completely obliterated ("pinchcock action of inspiration") and the phrenic ampulla is exaggerated. With swallowing, there is usually retention of barium in the phrenic ampulla and transient delay before the "empty segment" fills. This delay may be prolonged if the patient maintains a deep inspiration.

Much of the disagreement about the interpretation of the roentgen features centers around the location of the upper end of the empty segment, that is, its junction with the phrenic ampulla. This has been variously interpreted as the proximal margin of the "gastroesophageal vestibule," corresponding to the inferior esophageal sphincter (4, 9, 10), and as the junction between the thoracic and abdominal portion of the terminal esophagus, *i.e.*, the level of the hiatus (2, 5, 6, 11). If one starts with the (unwarranted) assumption that the level of the hiatus corresponds to the visualized portion of the left leaf of the diaphragm in the conventional right anterior oblique position, the proximal margin of the narrowed segment *seems* to be located above the hiatus. Those authors who have made this assumption (9, 10) have therefore concluded that the narrowing is of intrinsic contractile nature and that the relationship of the narrowed segment to the level of the hiatus of the dia-

<sup>1</sup> From the Department of Radiology and the Division of Gastroenterology of the Department of Medicine, The Mount Sinai Hospital, New York, N. Y. Accepted for publication in November 1960.

<sup>2</sup> Trainee, National Institutes of Arthritis and Metabolic Diseases.

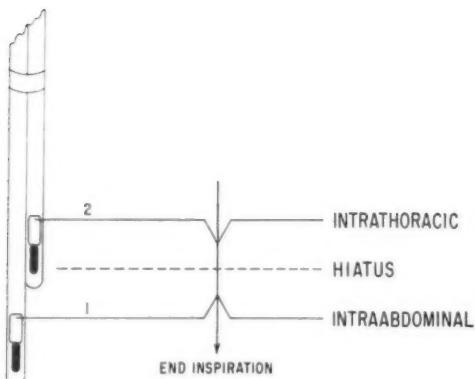


Fig. 1. Diagrammatic representation of method of locating the esophageal hiatus from intraluminal pressure curves when adjacent openings gave tracings with respiratory excursions in opposite directions. The record from the more distal opening (1) shows an upward deflection (increase in pressure) maximum at the end of inspiration. This opening is therefore located in the abdomen. The record from the opening located 1 cm. more proximally (2) shows a downward deflection (decrease in pressure) maximum at the end of inspiration. This opening is therefore located in the thorax. The point of inversion of pressure (PIP) or point of respiratory reversal (PRR), *i.e.*, the location of the physiological hiatus, may be assumed to be midway between the two openings with an error no greater than 5 mm. Points corresponding to the proximal ends of the openings, *i.e.*, to the effective ends of the water column, were used in transferring the position of PIP to the radiographs. Silver clips immediately distal to each opening (dark rectangles in the diagram) served as roentgen landmarks to identify the openings and the corresponding pressure tracings.

phragm is incidental rather than an essential or determining feature. With this point of view, it is necessary to assume that the pinchcock action of deep inspiration is not directly related to the hiatus or to the concurrent increase in intra-abdominal pressure but is due to a synchronous intrinsic contraction of the terminal esophagus itself. The other point of view in regard to the location of the junction between the phrenic ampulla and the narrowed segment, namely, that it corresponds to the position of the hiatus, has been confirmed by the studies with opaque markers mentioned above (5, 6). On the basis of the anatomical evidence, therefore, the narrow, empty, or junctional segment is simply the abdominal portion of the esophagus or the abdominal gullet. This segment, since it lies entirely within the relatively high-pressure abdominal compartment,

has also been referred to as the "submerged" or "sealed-off" segment (12, 13).

In the past several years, reliable methods of study of intraluminal pressures in the esophagus have been developed and utilized by many workers (14-19). In such studies, the location of the physiological or effective hiatus in normal individuals is clearly indicated by the reversal of the effects of respiration on the pressure tracings. A tracing taken from a point above the hiatus shows decrease in pressure with inspiration and increase in pressure with expiration, that is, intraesophageal pressures follow intrapleural pressure changes. On the other hand, a tracing taken from a point below the hiatus shows the opposite effects of respiration, that is, increasing pressure with inspiration and decreasing pressure with expiration. The level at which the change in the direction of respiratory excursions occurs has been referred to as the point of inversion of pressure (PIP) or the point of respiratory reversal (PRR). It is therefore possible to investigate the relationship between the level of the hiatus as determined by intraluminal pressure studies and the roentgen features of the barium-filled esophagus. Creamer *et al.* (12, 13) have combined cineradiographic observations with pressure measurements and the use of opaque hialal markers. Their evidence indicates that the physiologic or effective hiatus as determined by the pressure tracings coincides quite well with the anatomical hiatus and that both are located at the upper margin of the empty segment. The present report summarizes the findings in combined radiographic and pressure studies of 10 normal persons, as related to this particular problem.

#### METHODS AND PROCEDURES

Intra-esophageal pressure determinations were performed by a modification of the method reported by Pert *et al.* (20). Originally three and later six polyethylene tubes (Intramedic, I.D., 0.055 inches,

0.D. 0.075 inches, PE 200) of 3-foot lengths were taped parallel to one another. A metal olive was fixed to the distal ends of the tubes to facilitate passage and to minimize motion of the distal portion of the assembly when positioned in a subject. A single lateral opening 3 mm. in length and half the circumference of the tubing was made in each tube. These openings were so arranged that, in the combined assembly, the distance between the individual openings of the different tubes was 1 cm. A silver clip 4 mm. in length was fixed to the lower margin of each lumen to permit radiographic identification. These tubes or catheters were connected by means of adaptors to three Sanborn capacitance electromanometers. The tubes were perfused with water from an intravenous drip assembly maintained at constant pressure and flow rate. A direct-writing four-channel Sanborn Poly Viso oscillograph was used for recording the pressure tracings. Respirations were recorded from a pneumograph belt surrounding the lower portion of the thorax. The pneumograph recording system was so connected that inspiration caused a downward deflection and expiration an upward deflection.

The apparatus was arranged to permit recording of respiration and intraluminal pressure tracings from three tubes simultaneously. By suitable changes in the connections, any three of the intra-esophageal catheters could be chosen for recording purposes. Because of the large number of tubes used at one time, only a minimal amount of manipulation was required in order to position the openings in the desired location, that is, across the level of the physiological hiatus as indicated by the direction of respiratory excursions. In most instances, clear-cut opposite excursions were obtained in two adjacent openings 1 cm. apart and it was then assumed that the level of the physiological hiatus was midway between these openings (Fig. 1). In some cases, a diphasic tracing from one of the openings, with opposite deflections in the openings immediately above

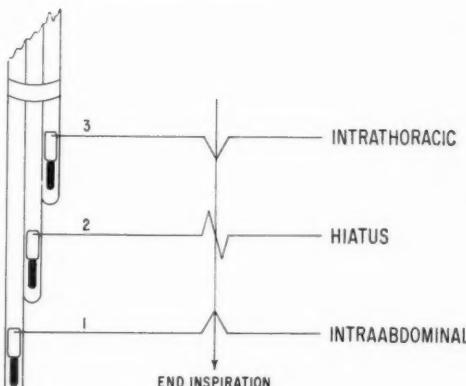


Fig. 2. Method of locating the hiatus when a diphasic tracing with inspiration was obtained from one opening, and monophasic oppositely directed tracings from adjacent openings. The most distal opening (1) shows a positive deflection (increase in pressure) maximum at the end of inspiration. The intermediate opening (2) shows a positive deflection with inspiration but the deflection is maximum prior to the end of inspiration and then returns toward the base line. The tracing from the most proximal opening (3) shows a downward deflection (decrease in pressure) maximum at the end of inspiration. In the observations reported, the distance between successive openings was 1 cm. With this type of record, it may be assumed that the hiatus corresponds to the level of the opening with the diphasic tracing.

and below, was recorded. In this latter type of tracing, it was assumed that the level of the hiatus was at the level of the opening showing the diphasic recording (Fig. 2). Previous studies have demonstrated that in quiet respiration, diphasic tracings may be obtained over a distance of about 5 mm. (15, 16). When correctly positioned, the tube assembly was taped to the left side of the face by a curved plastic shield in such a fashion that the tubes were in the center of the oral cavity. Radiographs demonstrated that the polyethylene catheters within the esophagus did not coil or become redundant and that little or no change in their position in a longitudinal direction occurred with swallowing or deep respiration.

The radiographic equipment consisted of a conventional horizontal table, overhead tube, and Bucky cassette tray. The patient was placed on the table in the prone right anterior oblique position and this was not changed at any time. After the tubes were in a suitable position as in

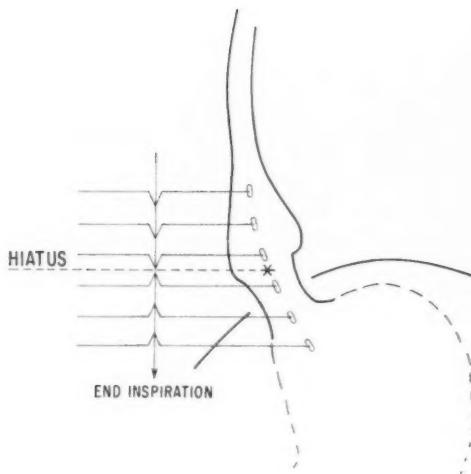


Fig. 3. Diagrammatic representation of 6-tube assembly positioned across the esophagogastric region. Typical respiratory excursions from openings 1 cm. apart are shown. The "hiatus" is taken as the point midway between the tracings which show opposite deflections with inspiration (PIP). In this diagram, the openings in the tubes are illustrated. On the radiographs, the silver clips attached immediately *distal* to each opening were used as landmarks to identify the openings.

dicated by the pressure tracings (Fig. 3), a scout film was obtained in quiet respiration, that is, without any command to the patient. A film was then taken during the course of swallowing of a rather dilute fluid barium mixture. The only instruction given to the patient was to drink continuously through a wide-bore straw extending into a full glass of barium. The film was taken after drinking was well established ("continuous drinking"), without any command to suspend respiration. Another film was then taken, the patient being requested, while swallowing the fluid barium mixture, to stop drinking and breathe in. The exposure was made toward or at the end of inspiration. On this film, it was possible to record pinch-cock action.

Pressure tracings were obtained before, during, and after the taking of each radiograph, and PIP was determined independently for each film. For the group of films taken during continuous drinking, the pressure tracings often did not record respiratory deflections of sufficient mag-

nitude to permit the localization of PIP during the actual course of drinking. In such instances, if the position of the diaphragm and the opaque clips were similar on the scout and drinking films, the tracings taken immediately before and after drinking were utilized for that purpose, provided these tracings gave identical results. For the films taken in inspiration, there was no difficulty in utilizing the inspiratory phase during the taking of the radiograph for the localization of PIP. From the physical point of view, the proximal ends of the side-holes in the tubes represent the terminations of the measuring water columns. Points corresponding to the proximal ends of the openings were therefore used in transferring the position of PIP to the radiographs.

## RESULTS

The results in the 10 normal persons were consistent and indicated clearly that, during continuous drinking and during inspiration, the junction of the phrenic ampulla and the narrower empty segment corresponds closely to the point of inversion of pressure as determined by intraluminal pressure studies (Figs. 4 and 5), *i.e.*, to the level of the hiatus. It is thus evident that the physiological studies confirm the anatomical findings that the narrowed segment which joins the phrenic ampulla to the fundus of the stomach lies entirely within the abdomen. From the roentgen point of view, therefore, the lower end of the phrenic ampulla serves as a useful landmark to indicate the position of the hiatus (Fig. 6). There is no similar landmark available on films taken without opacification of the esophagus (Fig. 7).

## DISCUSSION

From the results of this study and others reported in the literature, the fact that the lower margin of the phrenic ampulla or the upper margin of the narrowed segment corresponds to the transition between intrathoracic and intra-abdominal pressures can be considered to be well docu-

Fig. 4.  
of the term  
located in  
In other w  
these two  
esophagus

Fig. 5.  
The bariu  
responde

mented  
to conc  
action i  
of the  
esophagi  
this eff

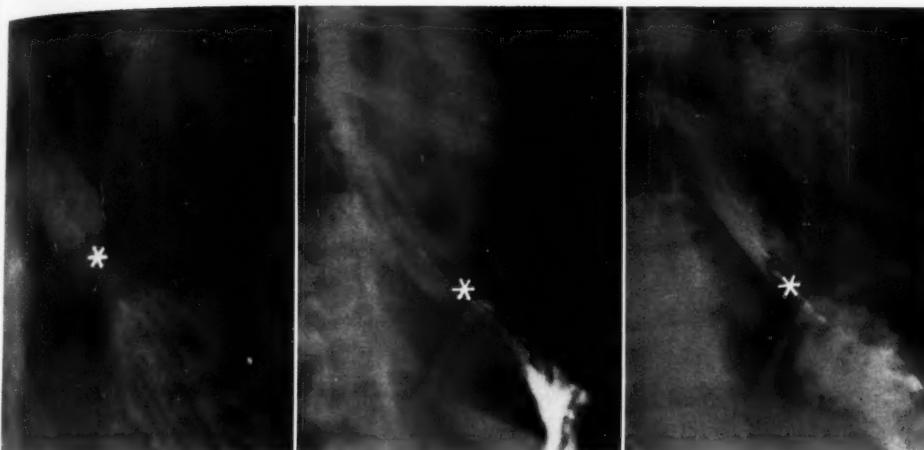


Fig. 4. Relationship of PIP (star), as determined by intraluminal pressure tracings, to the roentgen appearance of the terminal esophagus and esophagogastric region in 3 normal cases during drinking of fluid barium. The patients are lying in the right anterior oblique position. No command to suspend respiration was given. PIP was located in each instance at the junction of the distensible region ("phrenic ampulla") with the narrowed segment. In other words, the ampulla is epiphrenic and the narrowed segment is intra-abdominal. The junction between these two regions is a roentgen landmark for PIP, *i.e.*, for the hiatus. The linear lucencies in the course of the esophagus are due to the indwelling polyethylene tubes.

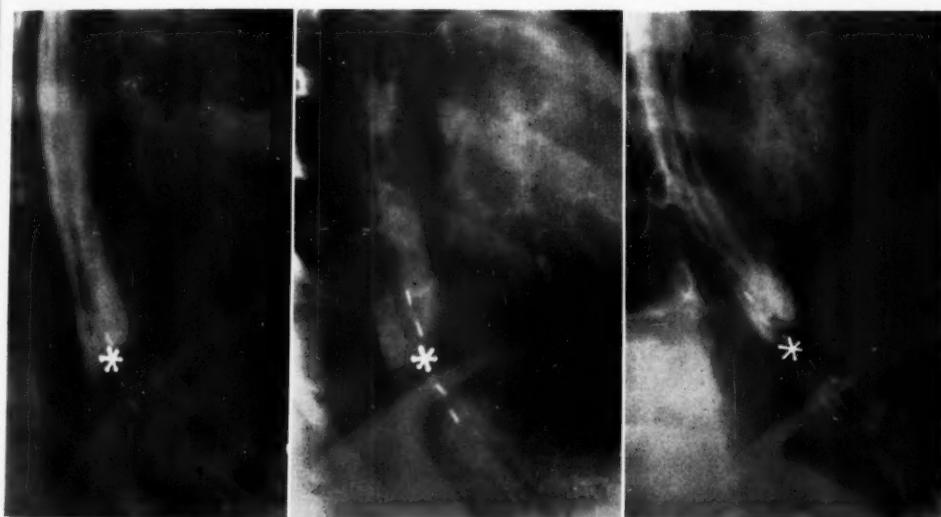


Fig. 5. Three normal cases showing the relationship of PIP (star) to the empty segment during inspiration. The barium column is completely interrupted as a result of pinchcock action. The upper end of this segment corresponds to PIP. Pinchcock action is effective only on the portion of the esophagus within the abdomen.

mented. It is not, however, necessary to conclude from this that the pinchcock action is the result of the direct application of the muscle fibers of the hiatus to the esophagus. It is much more likely that this effect, particularly in adults, is attributable to the special hydrodynamic

features which exist in this area (21). In many patients with obvious sliding hiatal hernias, pinchcock action between the herniated portion of the stomach and the intra-abdominal portion of the stomach may be quite evident. Intraluminal pressure measurements within these two por-

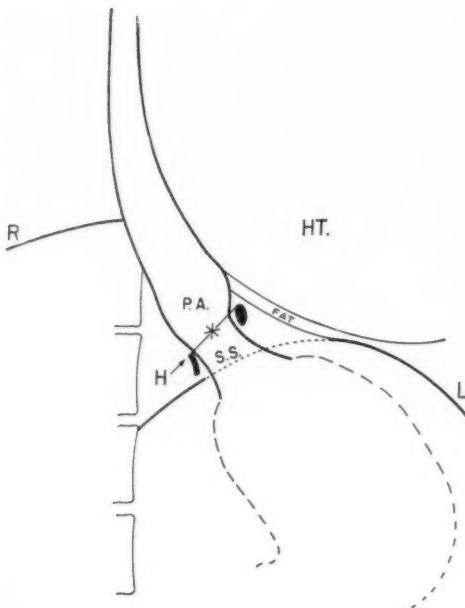


Fig. 6. Diagrammatic representation of the usual normal relationship of the level of the hiatus (H) to the dome of the left leaf of the diaphragm (L) in the right anterior oblique prone position. When the dotted portion of the dome is clearly delineated against lung, it is located posterior to the hiatus. A layer of fat intervening between the cardiac silhouette and soft tissue adjacent to the esophagus is usually evident. "P.A." refers to the phrenic ampulla or more distensible region immediately above the hiatus. "S.S." indicates the submerged segment (abdominal esophagus, abdominal gullet) which lies within the abdomen and extends to the cardia. In the right anterior oblique recumbent position, the right dome of the diaphragm (R) is at a considerably higher level than the left.

tions of the stomach in such instances demonstrate—as in normals—that the level of the pinchcock action and the physiological hiatus coincide (Fig. 8). It must be noted, however, that in some patients with sliding hernias, presumably those with an extraordinarily wide hiatus, there may be considerable difficulty in recognizing a unique position for the point of inversion of pressure and that a variety of types of intraluminal pressure curves may be obtained from the herniated portion of the stomach (22, 23).

Intraluminal pressure studies have demonstrated the presence of a sphincteric area 2 or 3 cm. in length in the terminal portion of the esophagus (12, 16-20). This has been equated with the "gastro-

esophageal vestibule" (10, 14, 20). The unique features of this area are that the resting intraluminal pressure is higher than the pressure within the fundus of the stomach and that the region relaxes promptly with the onset of drinking and prior to the arrival of the stripping peristaltic wave. Moreover, the terminal contraction in this area has a diminished amplitude and a prolonged period. It must be emphasized that these unique functional characteristics are identified on pressure tracings not only distal to the point of pressure inversion but also *proximal* to it, that is, above the hiatus of the diaphragm (12, 16, 17, 19). In other words, the proximal margin of this specialized or sphincteric area does *not* correspond to the position of PIP but is located more proximally. Stating this in roentgen terms, the "gastroesophageal vestibule," as demonstrated by intraluminal pressure tracings, extends above the junction of the phrenic ampulla and the narrowed segment, that is, into the phrenic ampulla for a variable distance.

It must be emphasized that the unique functional characteristics demonstrable by pressure tracings cannot be recognized in the conventional roentgen examination. The delay in the passage of barium often seen fluoroscopically in normal individuals in the distal esophagus occurs, not at the "inferior esophageal sphincter," but at the hiatus (12, 13). It may be possible, however, by cineradiographic techniques, applied particularly to patients with small hernias (2), to record special functional characteristics which may serve to identify the vestibule.

The abdominal portion of the esophagus is normally about 2 cm. in length. Since there is some question as to the nature of its lining epithelium, particularly distally, the term abdominal "gullet" has been suggested as more suitable than abdominal esophagus. The limited distensibility of this segment as compared with the epiphrenic portion may be correlated with the relatively greater intra-abdominal pressure.

The a  
esophage  
be predi  
of the di  
studies  
markers  
strated  
anterior  
prone, t  
the visi  
diaphra  
marizes  
study i  
hiatus—  
sure t  
phrenic  
"empty  
of the  
onstrat  
within

Addit  
opening  
PIP cou  
mm.) at

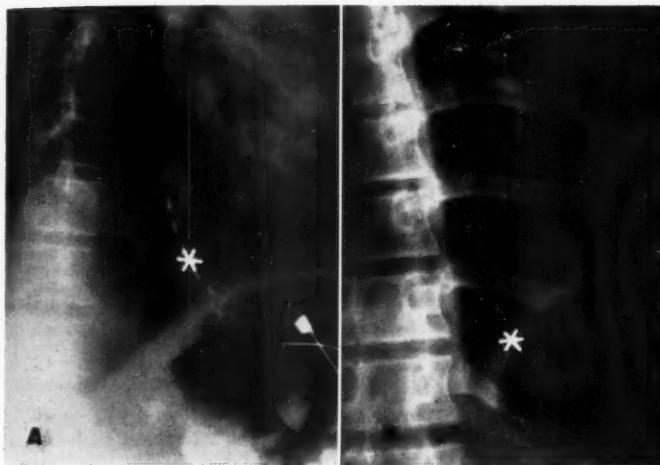


Fig. 7. Scout films showing relationship of PIP to the left leaf of the diaphragm in the prone right anterior oblique position. A. PIP (star), indicating the position of the hiatus, is located well above the left leaf of the diaphragm. B. In another patient, PIP (star) is approximately at the level of the left leaf. This low position is uncommon.

#### SUMMARY

The assumption that the position of the esophageal hiatus of the diaphragm can be predicted from the visualized portions of the diaphragm is incorrect. Anatomical studies of several authors with radiopaque markers placed on the hiatus have demonstrated that, in the conventional right anterior oblique position, with the patient prone, the hiatus is usually located above the visible portion of the left leaf of the diaphragm. The present report summarizes the observations in a combined study in respect to the relationship of the hiatus—identified on intraluminal pressure tracings—to the junction of the phrenic ampulla and the narrow or "empty" segment evident on barium filling of the esophagus. The findings demonstrate that this junction corresponds to the position of the hiatus and that the junctional segment therefore lies entirely within the abdomen.

#### ADDENDUM

Additional observations have been made with openings in the tubes 0.5 cm. apart instead of 1.0 cm. PIP could be more accurately located (within 2 or 3 mm.) at any point or instant during inspiration as



Fig. 8. Large direct or sliding hiatal hernia. Pinchcock action during drinking of barium shows a collapsed portion of stomach intervening between the hernial sac and the infradiaphragmatic portion of the stomach. Thick gastric folds protrude into the base of the hernial sac at the upper end of the collapsed segment. PIP (star) is located at the junction of the hernial sac and the collapsed segment.

lying between tracings with oppositely directed slopes. The conclusions from these studies are identical with those presented above.

The Mount Sinai Hospital  
11 E. 100th St.  
New York 29, N. Y.

## REFERENCES

1. TEMPLETON, F. E.: X-Ray Examination of the Stomach. Chicago, University of Chicago Press, 1944.
2. EVANS, J. A.: Sliding Hiatus Hernia. *Am. J. Roentgenol.* **68**: 754-763, November 1952.
3. WOLF, B. S., MARSHAK, R. H., SOM, M. L., BRAHMS, S. A., AND GREENBERG, E. I.: The Gastroesophageal Vestibule on Roentgen Examination: Differentiation from the Phrenic Ampulla and Minimal Hiatal Herniation. *J. Mt. Sinai Hosp., New York* **25**: 167-200, March-April 1958.
4. JOHNSTONE, A. S.: Observations on the Radiologic Anatomy of the Oesophagogastric Junction. *Radiology* **73**: 501-509, October 1959.
5. MONGES, H.: Considérations sur le rôle du diaphragme dans la physiologie de la continence gastroesophagienne et sur la projection radiologique de l'hiatus oesophagien. *Gastroenterologia* **86**: 232-241, 1956.
6. ROBERT, F., RAGUIN, M., AND WELFLING, P.: Anatomie radiologique de l'oesophage inférieur. *Semaine d. hôp. de Paris* **32**: 2065-2074, June 14, 1956.
7. BOTHA, G. S. M.: Radiological Localisation of the Diaphragmatic Hiatus. *Lancet* **1**: 662-664, March 30, 1957.
8. INGELFINGER, F. J.: Esophageal Motility. *Physiol. Rev.* **38**: 533-584, October 1958.
9. POPPEL, M. H., ZAINO, C., AND LENTINO, W.: Roentgenologic Study of the Lower Esophagus and Esophagogastric Junction. *Radiology* **64**: 690-700, May 1955.
10. ZDANSKY, E.: The Anatomical and Functional Basis of the Gastro-Oesophageal Reflux as seen Radiologically. *German M. Monthly* **4**: 331-334, October 1959.
11. WOLF, B. S.: Roentgen Features of the Normal and Herniated Esophagogastric Region. *Problems in Terminology. Am. J. Digest. Dis.* **5**: 751-769, September 1960.
12. CREAMER, B., AND PIERCE, J. W.: Observations on the Gastroesophageal Junction During Swallowing and Drinking. *Lancet* **2**: 1309-1312, Dec. 28, 1957.
13. CREAMER, B., HARRISON, G. K., AND PIERCE, J. W.: Further Observations on the Gastro-Oesophageal Junction. *Thorax* **14**: 132-137, June 1959.
14. SANCHEZ, G. C., KRAMER, P., AND INGELFINGER, F. J.: Motor Mechanisms of the Esophagus, Particularly of Its Distal Portion. *Gastroenterology* **25**: 321-332, November 1953.
15. DORNHORST, A. C., HARRISON, K., AND PIERCE, J. W.: Observations on the Normal Oesophagus and Cardia. *Lancet* **1**: 695-698, April 3, 1945.
16. FYKE, F. E., JR., CODE, C. F., AND SCHLEGEL, J. F.: The Gastroesophageal Sphincter in Healthy Human Beings. *Gastroenterologia* **86**: 135-150, 1956.
17. ATKINSON, M., EDWARDS, D. A. W., HONOUR, A. K., AND ROWLANDS, E. N.: Comparison of Cardiac and Pyloric Sphincters; a Manometric Study. *Lancet* **2**: 918-922, Nov. 9, 1957.
18. TEXTER, E. C., JR., SMITH, H. W., MOELLER, H. C., AND BARBORKA, C. J.: Intraluminal Pressures From the Upper Gastrointestinal Tract. I. Correlations with Motor Activity in Normal Subjects and Patients with Esophageal Disorders. *Gastroenterology* **32**: 1013-1024, June 1957.
19. BOTHA, G. S. M., ASTLEY, R., AND CARRÉ, I. J.: A Combined Cineradiographic and Manometric Study of the Gastro-Oesophageal Junction. *Lancet* **1**: 659-662, March 30, 1957.
20. PERT, J. H., DAVIDSON, M., ALMY, T. P., AND SLEISINGER, M. H.: Esophageal Catheterization Studies. I. The Mechanism of Swallowing in Normal Subjects with Particular Reference to the Vestibule (Esophago-Gastric Sphincter). *J. Clin. Invest.* **38**: 397-406, February 1959.
21. WOLF, B. S.: The Esophagogastric Closing Mechanism: Role of the Abdominal Esophagus. *J. Mt. Sinai Hosp., New York* **27**: 404-416, July-August 1960.
22. CREAMER, B.: Oesophageal Reflux. *Lancet* **1**: 279-281, Feb. 5, 1955.
23. ATKINSON, M., EDWARDS, D. A. W., HONOUR, A. J., AND ROWLANDS, E. N.: The Oesophagogastric Sphincter in Hiatus Hernia. *Lancet* **2**: 1138-1142, Dec. 7, 1957.

## SUMMARIO IN INTERLINGUA

## Localisation Radiologic del Hiato Esophagee Determinate per Mesuraciones del Pression Intraluminal

Le idea que le position del hiato esophagee del diaphragma pote esser predicte ab le visualisable portiones del dia phragma non es correcte. Studios anatomic per plure autores, utilisante marcas radio-opac placiate super le hiato, ha demonstrate que in le position dextero-anterior oblique conventional, con le paciente in decubito ventral, le hiato es usualmente locate supra le visible portion del lobo sinistre del diaphragma. Le presente reporto summarisa le observations facite

in un studio combinante con respecto al relation inter (1) le hiato como illo es identificate in registrationes de pression intraluminal e (2) le junction del ampulla phrenic con le restringite o "vacue" segmento que es evidente post le replenation del esophago a barium. Iste constatactiones demonstra que iste junction corresponde al position del hiato e que le segmento junctional jace per consequente completamente intra le abdomen.

ME  
It has bee  
since 193  
received  
ture. It  
of the re  
cysts of  
dilatatio  
(22), re  
simply s  
Lenardu  
medullar  
appearan

The P  
to the n  
and cons  
tubules  
multiple  
Some of  
shown t  
tubules,  
branched  
structure  
culi. M  
involved  
a single

The c  
with see  
to pyra  
enlarge  
but oth  
the lesi  
be enla  
and ure  
by the  
namely  
tion, an

The  
is unk

<sup>1</sup> From  
sented at  
4-9, 1960

# Medullary Sponge Kidney<sup>1</sup>

A. J. PALUBINSKAS, M.D.

MEDULLARY SPONGE kidney is not a new clinical and pathologic entity. It has been described by European authors since 1939 (12) but only recently has it received attention in the English literature. It has also been called cystic disease of the renal pyramids (15, 21), multiple cysts of the renal medulla (10), cystic dilatation of the renal collecting tubules (22), renal tubular ectasia (19), and simply sponge kidney (3, 5, 17, 20). Lenarduzzi in 1939 (12) first used the term medullary sponge kidney, likening the appearance of the medulla to a sponge.

## DESCRIPTION

The pathologic changes are confined to the medullary portions of the kidney and consist of dilatation of the collecting tubules of the pyramids associated with multiple small cysts and cyst-like cavities. Some of these cystic structures have been shown to communicate with the ectatic tubules, and the dilated, sometimes branched collecting tubules and small cystic structures frequently contain small calculi. More commonly, both kidneys are involved, but the lesion may be limited to a single pyramid.

The changes in the kidney vary greatly, with seemingly normal pyramids adjacent to pyramids that are grossly involved, enlarged, and with flattened and shallow but otherwise normal minor calyces. If the lesion is generalized, the kidney may be enlarged, but the cortex, calyces, pelvis, and ureter are not unusual unless affected by the complications of the disease, namely, repeated infections, stone formation, and passage of stones.

## ETIOLOGY

The cause of medullary sponge kidney is unknown; most authors agree that it

represents a developmental defect in the formation of the renal collecting tubules. Fleischner (8) described the disease as a heredofamilial one, and its occurrence in siblings has been reported (4). Two brothers with the disease are currently being studied at this hospital.

## INCIDENCE

The condition is uncommon. In 1960 Abeshouse and Abeshouse (1) were able to collect 131 cases from the literature and added 5 of their own. The largest single series to date (44 cases) was reported by Ekström *et al.*, in their comprehensive monograph on the subject (7).

In the sixteen-month period from July 1959 through October 1960, 29 instances of medullary sponge kidney were seen at the University of California Medical Center. Fourteen of these were found in the course of intravenous urography, an overall incidence of approximately 0.5 per cent of 2,465 consecutive urograms. Of the remaining 15 patients, 11 were examined at other hospitals and the urograms were seen in consultation, and 4 were patients investigated at this hospital prior to the sixteen-month study period. In this same urographic series, an additional 12 patients were suspected of having medullary sponge kidney, but a definite roentgen diagnosis could not be made for one of several reasons: poor preparation of the bowel, unsatisfactory technical quality of films, mildness of the disease, or severe secondary complications obscuring the underlying primary etiology.

## AGE AND SEX

Medullary sponge kidney is generally discovered in middle age but has been found in young children and in the aged. All 29 patients seen in this hospital were

<sup>1</sup>From the Department of Radiology, University of California, School of Medicine, San Francisco, Calif. Presented at the Forty-sixth Annual Meeting of the Radiological Society of North America, Cincinnati, Ohio, Dec. 4-9, 1960.

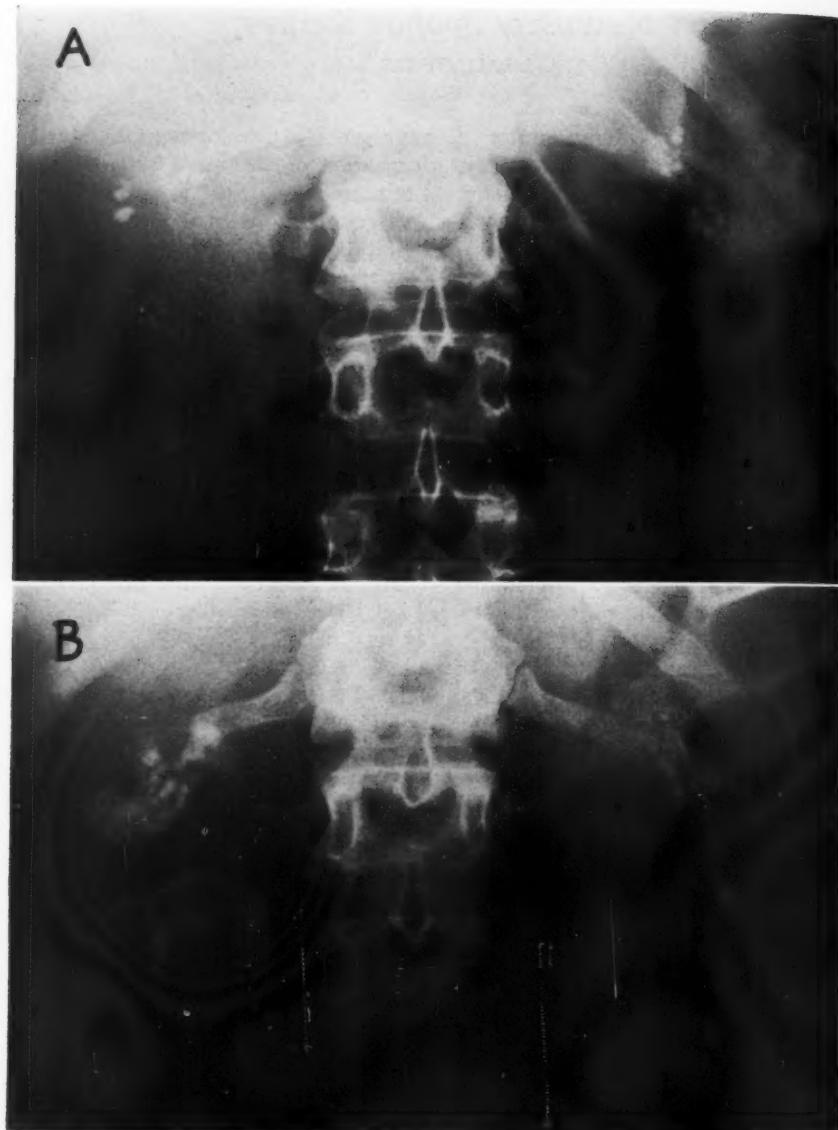


Fig. 1. A 23-year-old white female with a history of recurrent attacks of frequency, dysuria, left flank pain, and fever for three and a half years. A plain film of the abdomen (A) and excretory urogram (B) demonstrate the classical picture of well developed medullary sponge kidney. Note the apparent "absence" of involvement in the lower two-thirds of the left kidney and the distribution and configuration of the many pyramidal concretions in both kidneys.

adults, except one, a three-week-old male infant. It is not known whether this child represents an example of renal tubular ectasia with cystic disease of the kidneys and liver as reported by Reilly and Neuhauser (19).

In the published reports, males predominate in a ratio of 2.5 to 1 (1). The largest single series recorded (7) included 23 males and 21 females. There were 17 males and 12 females in the present group of 29 patients.

py  
lat  
tic  
me  
ca

In m  
the urin  
dition 1  
of minu  
cretory  
other th  
ally, ho  
develop  
the pa  
which  
Most f  
recurre  
scopic  
sympto

Ren  
uncom  
istry i  
howeve  
what re

Wh  
findin



Fig. 2. A 35-year-old white female with a ten-year history of nephrolithiasis with recurrent pyelonephritis and renal colic. An excretory urogram demonstrates the classical picture of bilateral advanced medullary sponge kidney somewhat altered by chronic and recurrent complications. Bilateral pyramidal concretions are present. The arrow directs attention to contrast medium in a hydrocalyx; this calyx and/or its obscured pyramid contained a large number of calculi measuring up to 8 mm.

#### CLINICAL OBSERVATIONS

In mild cases, symptoms referable to the urinary tract may be absent, the condition being disclosed by the discovery of minute calculi in the kidneys or by excretory urograms obtained for reasons other than urinary tract symptoms. Usually, however, by the time concretions have developed in the cavities or ectatic tubules, the patients have symptoms and signs which direct attention to the kidneys. Most frequently these are evidences of recurrent kidney infection, gross or microscopic hematuria, pyuria, renal pain, or symptoms referable to passage of calculi.

Renal function is not impaired in the uncomplicated cases and the blood chemistry is normal. Many of the patients, however, have hypercalciuria and a somewhat reduced urine concentration capacity.

#### ROENTGENOLOGIC FINDINGS

Whereas symptomatology and clinical findings are nonspecific, the roentgeno-

grams in fully developed cases present a distinctive appearance. Lindvall (14) considers the urographic picture characteristic, and all but one of the 44 cases reported by Ekström were regarded as "roentgenologically pathognomonic."

The distinctive features are best demonstrated by excretion urography; only some of the cavities are filled on retrograde pyelography. Occasionally the appearance and distribution of renal calculi seen on plain films of the abdomen will suggest the diagnosis prior to urography.

The classical picture of the disease as seen in plain films and in excretory urograms is demonstrated in Figures 1 and 2. Ectatic tubules and numerous calculi of various shapes and small size are present in the pyramids. Cyst-like cavities in communication with the collecting tubules fill with contrast medium, but commonly the identification of individual cavities is obscured by the shadows of dilated tubules and opaque calculi. Some of the

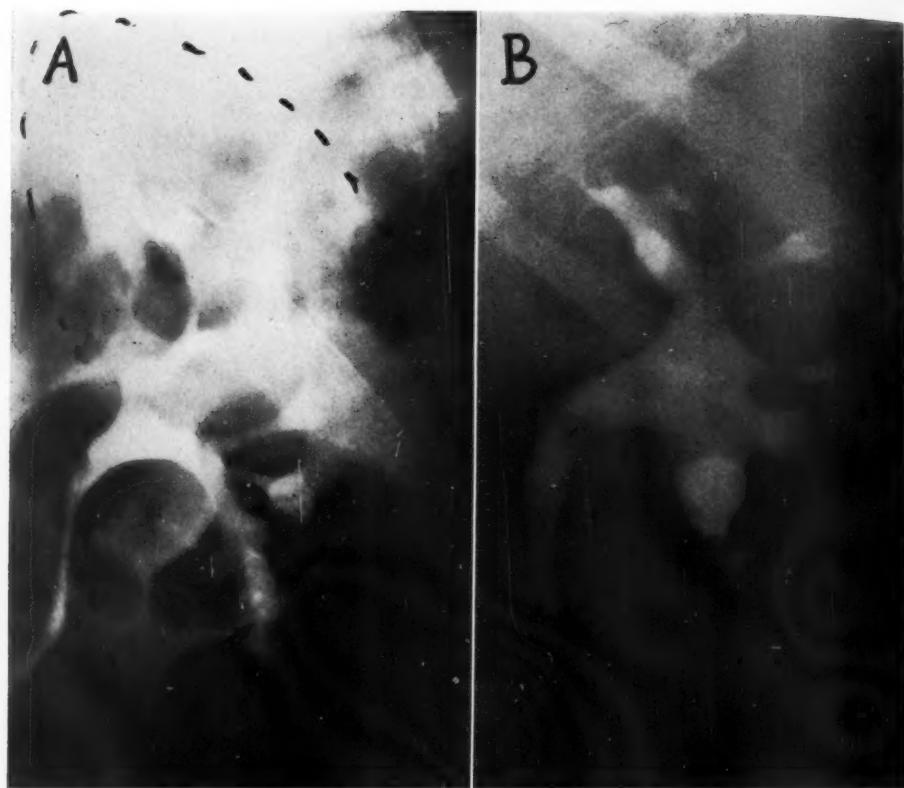


Fig. 3. A. Less pronounced changes of sponge kidney (arrows) in a 71-year-old white male with a history of renal stones. Only the excretory urogram of the left kidney is shown, but the disease was present bilaterally. Opaque stones, poorly defined on the excretory urogram, are present in the lowermost pyramid. The patient's asymptomatic brother was examined and found to have sponge kidney localized to a single group of pyramids.

B. Excretory urogram (left kidney) of a young adult white female under treatment for chronic schizophrenia. The patient had a history of previous operation for uretero-pelvic junction stricture on the right. An intrarenal mass, felt to represent solitary cyst, is present in the middle third of the left kidney. The lowermost pyramids (arrows) show changes of medullary sponge kidney.

cysts do not fill, and occasionally, particularly if they are located in the papillary region just beneath the calyceal mucosa, they can be visualized as small round radiolucent defects.

The appearance of the pyramids as seen in Figures 1 and 2 has been described by some authors as "porous complexes" (9) and "bouquet of flowers" images (18). Lhez (13) has divided the roentgenologic appearances into four urographic types: (a) initial forms; (b) forms with numerous cavities; (c) forms with additional alterations of the excretory tract; (d) forms with superadded lithiasis. Similarly Di Sieno (6) has outlined four types: (a)

"fan-like" images of dilated tubules; (b) "bunch of flowers" images due to ectatic tubules associated with formation of microcystic diverticula of the collecting tubules; (c) "bunch of grapes" images due to the presence of cystic formations; (d) "mosaic-like" images resulting from a disordered conglomeration of cysts and cavities of different forms and dimensions scattered in the pyramids.

Stripped of botanical imagery, the various descriptions and types appear to represent varying degrees of involvement of the pyramids—mild, moderate, severe, or severe with superimposed morphological changes secondary to complications of

Fig. 4. B. I. uretero-pyramidal changes

infection. Involvement with a minor cyst is generally limited to the pyramids, the

prominent complications of chronic disease, a

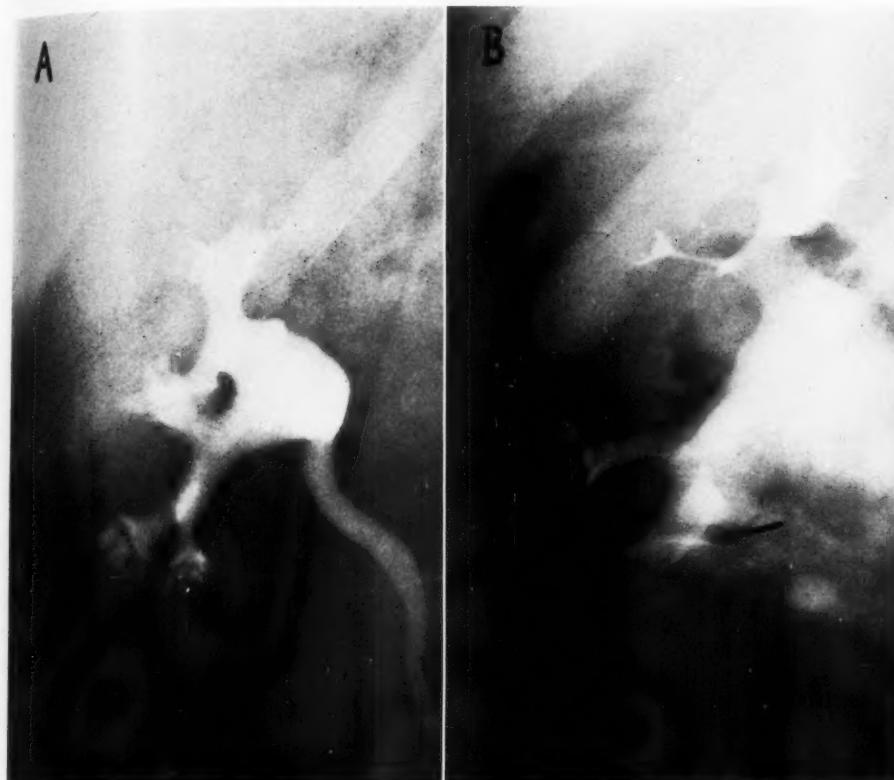


Fig. 4. A. Excretory urogram (right kidney) of a young adult white male with bilateral medullary sponge kidney. Note the varying degrees of ectasia of the collecting tubules.

B. Excretory urogram (right kidney) of a 32-year-old white male with a previous history of right ureterotomy and nephrostomy for impacted ureteral calculus. Plain films revealed multiple stones in the pyramids of the lower half of the enlarged right kidney (long diameter 15 cm.). Increased size of one of the lower pole pyramids has produced a pronounced flattening of its minor calyx (arrow). No recognizable changes of sponge kidney on the left side.

infection, stasis, and calculus formation.

Involved pyramids may be enlarged, with a concomitant flattening of their minor calyces (Fig. 4, B) and, if the process is generalized in many or all of the pyramids, the kidney may be enlarged (Figs. 4, B; 5, B; 5, B'). The severity of the medullary changes may vary considerably within the same kidney (Fig. 1) and, although both kidneys are more often affected, the pathologic changes may be limited to one or a few pyramids (Fig. 6).

Promptness and density of excretion of contrast medium are normal in the uncomplicated cases. On the other hand, chronic recurrent infections, stone formation, and the sequelae of passage of cal-

culi may alter the classical appearance, confuse recognition of the primary etiologic changes, and impair the excretory capacity of the kidneys. Generally, however, the disease may continue over long periods of time with little alteration in the appearance of kidneys except for changes in the size, number, and distribution of calculi (Figs. 5, A and 5, A').

#### DIFFERENTIAL DIAGNOSIS

Authorities agree that well developed medullary sponge kidney presents a typical or characteristic roentgenologic picture quite distinct from any other renal lesion. Some authors, as already mentioned, consider the appearance "roentgenologically

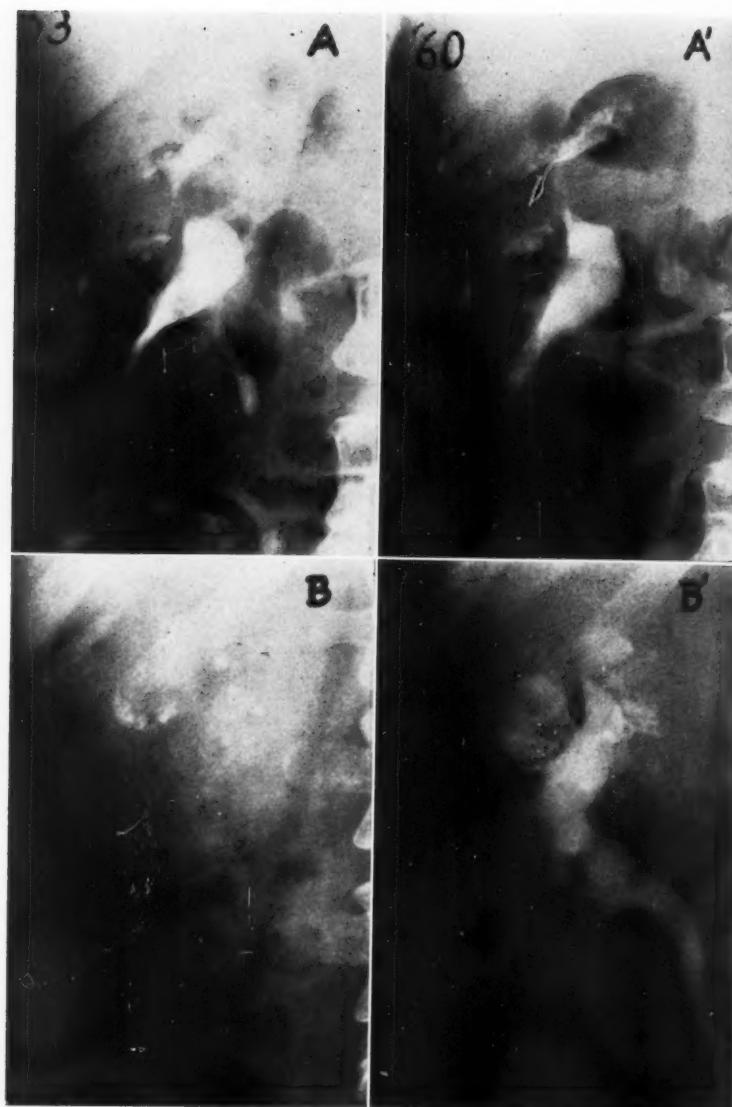


Fig. 5. A and A'. Excretory urograms of a 61-year-old white male with bilateral medullary sponge kidney, demonstrating the interval change in the appearance of the right kidney over a period of seven years. The greatest change was a conspicuous enlargement of concretions in the inferior pyramids, seen best on the preliminary films of the abdomen.

B and B'. Plain film and intravenous urogram (right kidney) of a young white male adult with bilateral sponge kidney demonstrating calculi, enlarged pyramids, and ectatic tubules. Both kidneys were considerably enlarged.

pathognomonic" (6, 7). Nevertheless, a definite problem in the differential diagnosis is presented, particularly when the condition is minimal, or when the changes are localized to a single or a focal group

of pyramids, or when the classical appearance has been altered by complications.

Most often medullary sponge kidney must be differentiated from renal tuberculosis, renal papillary necrosis, pathologic

Fig. 6  
35-year-  
old male

processes  
cinosis (p  
renal tub  
calyceal  
variously  
blush,"  
different  
plicated  
lesions in  
renal tu  
have be  
(7), and  
tcula is

A num  
16, 18, 2  
diagnos  
will be p

Calcif  
renal tu  
pyramide  
frequent  
stricture  
ureter, o  
may rev

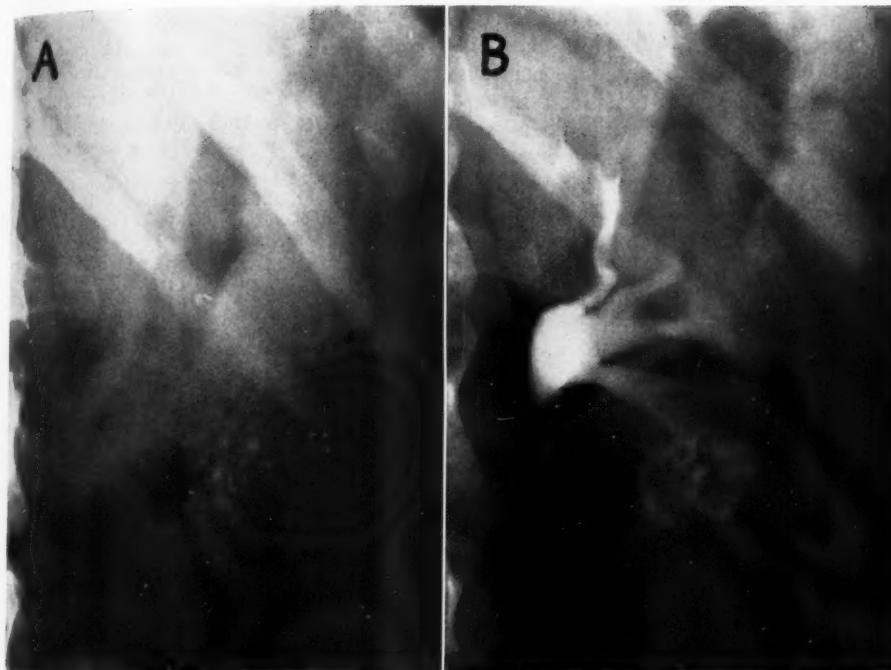


Fig. 6. Sponge kidney localized to a single pyramidal group in the lower pole of the left kidney of a 35-year-old white female who had no urinary tract symptoms. A. Plain film demonstrating multiple pyramidal concretions. B. Excretory urogram.

processes producing so-called nephrocalcinosis (particularly hyperparathyroidism, renal tubular acidosis, and pyelonephritis), calyceal diverticula, and the phenomenon variously called "tubular stasis," "tubular blush," and "pyelotubular reflux." The differential diagnosis can be further complicated by the presence of combined lesions in rare instances. For example, both renal tuberculosis and papillary necrosis have been reported with sponge kidney (7), and the association of calyceal diverticula is not uncommon.

A number of authors (1, 2, 7, 10, 14, 16, 18, 21) have discussed the differential diagnosis in detail, and only major criteria will be presented here.

Calcifications and cavities occurring with renal tuberculosis seldom involve only the pyramids and, except for early lesions, frequently show associated changes of stricture and scarring of the calyces, pelvis, ureter, or bladder. Chest roentgenograms may reveal pulmonary tuberculosis. The

final diagnosis depends on the demonstration of Koch's bacillus.

Renal papillary necrosis (11) is most frequently associated with diabetes, phenacetin poisoning, or obstruction of the urinary tract. Sloughed papillae, encrusted with calcium salts, produce a distinctive roentgenologic appearance of central radiolucency and opaque periphery, and, if present, are quite directive in making the diagnosis. The clinical course, passage of tissue in the urine, and frequently altered renal function, are other differentiating features.

Clinical and laboratory studies are necessary for definitive isolation of the cause of nephrocalcinosis where any doubt exists. Most frequently the important possibilities are hyperparathyroidism and renal tubular acidosis, both of which have well recognized metabolic and biochemical findings.

Calyceal diverticula seldom present a problem in recognition. They are usually larger than the cystic dilatations of sponge

kidney and are connected to the fornix of the minor calyx by a thin channel. Occasionally they are seen in association with sponge kidney, but a direct relationship between the two has not been defined.

In the author's personal experience, the differential diagnosis between mild medullary sponge kidney and so-called "tubular stasis," particularly when the latter is pronounced, has been difficult. Further study is necessary to establish sharper criteria for their separation if, in fact, such a division exists.

#### TREATMENT AND PROGNOSIS

There is no specific treatment for sponge kidney itself, and therapy is directed toward the control of the complications, such as infection, hematuria, and obstructing calculi. Serious complications may require urologic surgery when possible. The prognosis varies with the severity of the secondary complications, but in the majority of cases it is good.

#### SUMMARY

Medullary sponge kidney is an uncommon lesion of the renal medulla characterized by ectasia of the collecting tubules and by small cystic changes in the pyramids. In a series of 2,465 intravenous urograms, 14 examples of the disease were found. There are no specific symptoms, clinical findings, or therapy. The etiology is unknown, but apparently the entity represents a congenital malformation of the collecting tubules.

The excretory urograms of 29 patients with medullary sponge kidney have been seen at the University of California Medical Center in the past sixteen months; 11 of this group were examined at other hospitals and the urograms seen in consultation. Selected roentgenograms from 9 of these 29 patients have been presented and the roentgenologic features of the disease are discussed.

Department of Radiology  
University of California Medical Center  
San Francisco 22, Calif.

#### REFERENCES

1. ABESHOUSE, B. S., AND ABESHOUSE, G. A.: Sponge Kidney: A Review of the Literature and a Report of Five Cases. *J. Urol.* **84**: 252-267, August 1960.
2. ABESHOUSE, B. S., AND SALIK, J. O.: Pyelographic Diagnosis of Lesions of the Renal Papillae and Calyces in Cases of Hematuria. *Am. J. Roentgenol.* **80**: 569-589, October 1958.
3. DARGET, R., AND BALLANGER, R.: Sur un cas de rein "en éponge." *J. urol.*, Paris **60**: 713-715, 1954.
4. DELL'ADAMI, G., AND MENEGHINI, C.: Il "rene a spugna;" la prima osservazione in consanguinei. *Arch. ital. urol.* **27**: 81-89, 1954. Cited by Ekström, T. *et al.* (7).
5. DELZOTTO, L., AND TURCHETTO, P.: Il rene a spugna; contributo casistico. *Urologia* **22**: 240-244, June 20, 1955.
6. DI SIENO, A., AND GUARESCHI, B.: Il quadro radiologico del rene a spugna midollare (R.S.M.); revisione della letteratura e presentazione di due casi. *Radiol. clin.* **25**: 80-103, March 1956.
7. EKSTRÖM, T., ENGFELDT, B., LAGERGREN, C., AND LINDVALL, N.: Medullary Sponge Kidney. Stockholm, Almqvist & Wiksell, 1959.
8. FLEISCHNER, F. G., BELLMAN, S., AND HENKEN, E. M.: Papillary Opacification in Excretory Urography. The So-Called Pyelotubular Reflux. *Radiology* **74**: 567-572, April 1960.
9. HICKEL, R.: Un cas de "rein en éponge." *J. urol.*, Paris **59**: 408-411, 1953.
10. IBACH, H. F., AND LARSEN, L. L.: Roentgen Manifestations of Multiple Cysts of the Renal Medulla. *Radiology* **75**: 363-367, September 1960.
11. LAGERGREN, C., AND LINDVALL, N.: Renal Papillary Necrosis; Roentgenologic Diagnosis and Formation of Calculi. *Acta radiol.* **49**: 249-268, April 1958.
12. LENARDUZZI, G.: Reporto pieiografico poco comune dilatazione delle vie urinarie intrarenali. *Radiol. med.*, Torino **26**: 346-347, 1939.
13. LHEZ, A.: Le rein en éponge (douze observations). *J. urol.*, Paris **60**: 575-588, 1954.
14. LINDVALL, N.: Roentgenologic Diagnosis of Medullary Sponge Kidney. *Acta radiol.* **51**: 193-206, March 1959.
15. MULVANEY, W. P., AND COLLINS, W. T.: Cystic Disease of the Renal Pyramids. *J. Urol.* **75**: 776-779, May 1956.
16. MURPHY, W. K., PALUBINSKAS, A. J., AND SMITH, D. R.: Sponge Kidney. To be published in *J. Urol.*
17. PENNISI, S. A., AND BUNTS, R. C.: Sponge Kidney. *J. Urol.* **84**: 246-251, August 1960.
18. PETKOVIC, S.: Contribution à l'étude de la maladie kystique des pyramides rénales. *J. urol.*, Paris **58**: 425-432, 1952.
19. REILLY, B. J., AND NEUHAUSER, E. B. D.: Renal Tubular Ectasia in Cystic Disease of the Kidneys and Liver. *Am. J. Roentgenol.* **84**: 546-554, September 1960.
20. RONCHITELLI, R., AND BELON, A.: Considerazioni sul rene a spugna. *Policlinico (sez. prat.)* **60**: 1241-1245, Sept. 7, 1953.
21. RUBIN, E. L., ROSS, J. C., AND TURNER, D. P. B.: Cystic Disease of the Renal Pyramids ("Sponge Kidney"). *J. Fac. Radiologists* **10**: 134-137, July 1959.
22. VERMOOTEN, V.: Congenital Cystic Dilatation of the Renal Collecting Tubules; A New Disease Entity. *Yale J. Biol. & Med.* **23**: 450-453, June 1951.

## SUMMARIO IN INTERLINGUA

## Ren a Medulla Spongiose

Ren a medulla spongiose es un lesion incomun del medulla renal, characterisate per ectasia del tubulos de collection e per mire alterationes cystic in le pyramides. In un serie de 2.465 urogrammas intravenose, 14 exemplos del morbo esseva trovate. Il non existe specific symptomas, constatações clinic, o formas de therapia. Le etiologia non es cognoscite, sed apparentemente le entitate representa un malformation congenite del tubulos de collection.

Durante que le symptomatologia e le constatações clinic non es specific, le roentgenogrammas in plenamente disveloppate casos de ren a medulla spongiose presenta un apparentia distinctive. Le tractos significative es demonstrare le melio per urographia excretori, ben que a vices le diagnose es sugerite per le distribution del calculos renal vidite in le

pellicula ordinari. Le tableau classic include tubulos ectatic e numerose mire calculos de varie formas inle pyramides. Cavitates cystoide in communication con le tubulos de collection se replena con le substantia de contrasto, sed communmente le identification de cavitates individual es obscure per le umbras de tubulos dilatate e de calculos opac. Certes del cystes non se replena; a vices, particularmente si illos se trova in le region papillar justo infra le mucosa calyce, illos es visualisabile como mire, rotunde defectos radiolucente.

Al Centro Medical del Universitate California le urogrammas excretori de 29 patientes con renes a medulla spongiose esseva vidite in le curso del passate decessex menses. Dece-un del patientes habeva essite examinata a altere hospitalas e le urogrammas esseva vidite in consultation.



## Medullary Sponge Kidney

Roentgen Diagnosis of Three Cases<sup>1</sup>

P. G. SECREST, M.D., and TOM A. KENDIG, M.D.

Due to the very limited number of case reports in the American literature of the condition now termed medullary sponge kidney, 3 cases diagnosed roentgenologically will be reported. The first case will be presented in some detail and the others more briefly.

The term "medullary sponge kidney" was first used in 1939 by Lenarduzzi (1) to describe a condition in which a part or all of the medullary portion of one or both kidneys exhibited a sponge-like appearance caused by the presence of small multiple cysts or cavities which were believed to be formed by dilated collecting tubules. Occasional articles had previously appeared in the literature reporting similar observations, but the significance of the finding was first well documented by Lenarduzzi. In the American literature reports of this condition have been very few. In 1951 Vincent Vermooten (2) reported a case he had seen in 1943. In a footnote he referred to a personal communication from Dr. Wyland Leadbetter, who had seen the lesion at least five times. Mulvaney and Collins (3) reviewed some of the literature and presented a case fitting this category, though the occurrence of cortical cysts in their patient suggested that they were not necessarily dealing with the same entity.

Nils Lindvall (4) made a more thorough review of the literature and on examination of the material at the Karolinska Hospital (Stockholm) for the years 1940-42 and 1954-58 found 31 cases with the characteristic appearance of medullary sponge kidney. Four cases from other hospitals in Sweden were also included. In the majority of the reported cases, the diagnosis had been made on the pyelographic appearance of the kidneys. Various stages

from involvement of a single pyramid to involvement of all pyramids of one or both kidneys have been described. The characteristic finding was dilated structures thought to represent abnormal collecting tubules with or without calcification. Some cases have presented the appearance of frank cystic structures involving the pyramids; in others elongated dilated tubular structures are seen. A typical feature has been the retention of opaque medium for a longer time in these structures than in the calyceal system.

### CASE REPORTS

CASE I: M. E., a 35-year-old white female, was seen on March 8, 1957, on the Medical Service (P.G.S.). Her chief complaint was epigastric pain of three months duration, accompanied by increased borborygmi, eructation, and flatulence. She became fatigued easily and was extremely nervous, being especially concerned about her health. The past history was significant in that she had been hospitalized on June 18, 1955, in the seventh month of a pregnancy, for severe right flank pain. This radiated to the right groin and thigh and there was tenderness in the right flank. Urine examination at that time showed microscopic hematuria, and a diagnosis of right renal colic was made, although no x-ray studies were done. The history was otherwise noncontributory.

The family history was of interest in that the grandmother had diabetes and the mother had "heart disease" and hypertension. The patient had drunk approximately a quart of milk daily for many years. There had been no supplemental vitamin D intake and she did not use tobacco, alcohol, or any drugs.

On admission the patient appeared healthy, with no contributing positive physical findings. Laboratory studies, which included a complete blood count and urinalysis, were within normal limits. Serum calcium was 9.6 mg. per cent and the serum phosphorus was 3.9 mg. per cent. Sulkowitch's test for urinary calcium was considered normal. A water test for Addison's disease produced a normal response. A PPD second strength skin test was 2+, but the chest film and cholecystogram were negative.

<sup>1</sup> From the Departments of Medicine and Radiology, The Harriman Jones Medical Clinic and Hospital, Long Beach, Calif. Accepted for publication in November 1960.

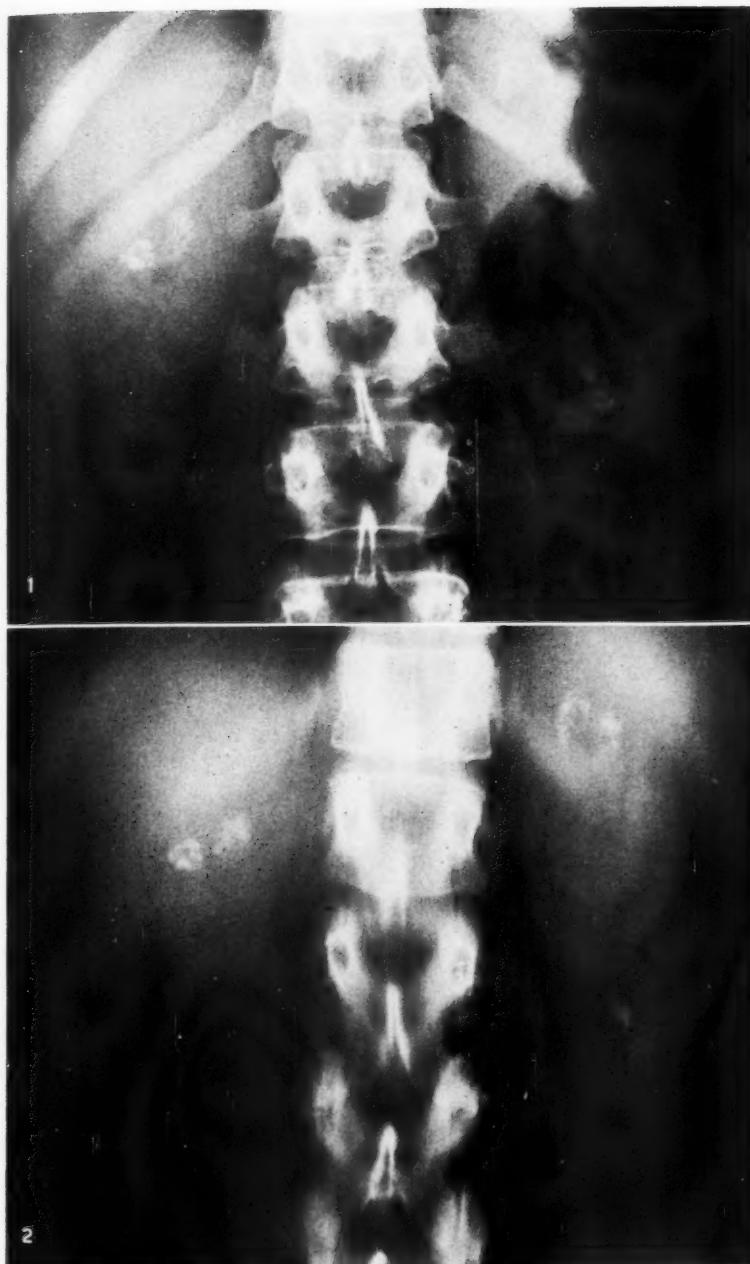


Fig. 1. Case I. Preliminary film of the abdomen demonstrating multiple areas of calcification in the upper pole of the right kidney and upper and lower poles of left kidney, subsequently shown to occupy the pyramids of the calyceal system supplying these areas.

Fig. 2. Case I. Planigraphic section through the kidneys demonstrating the distribution and character of the calcific deposits in the pyramids of the involved portion of each kidney.

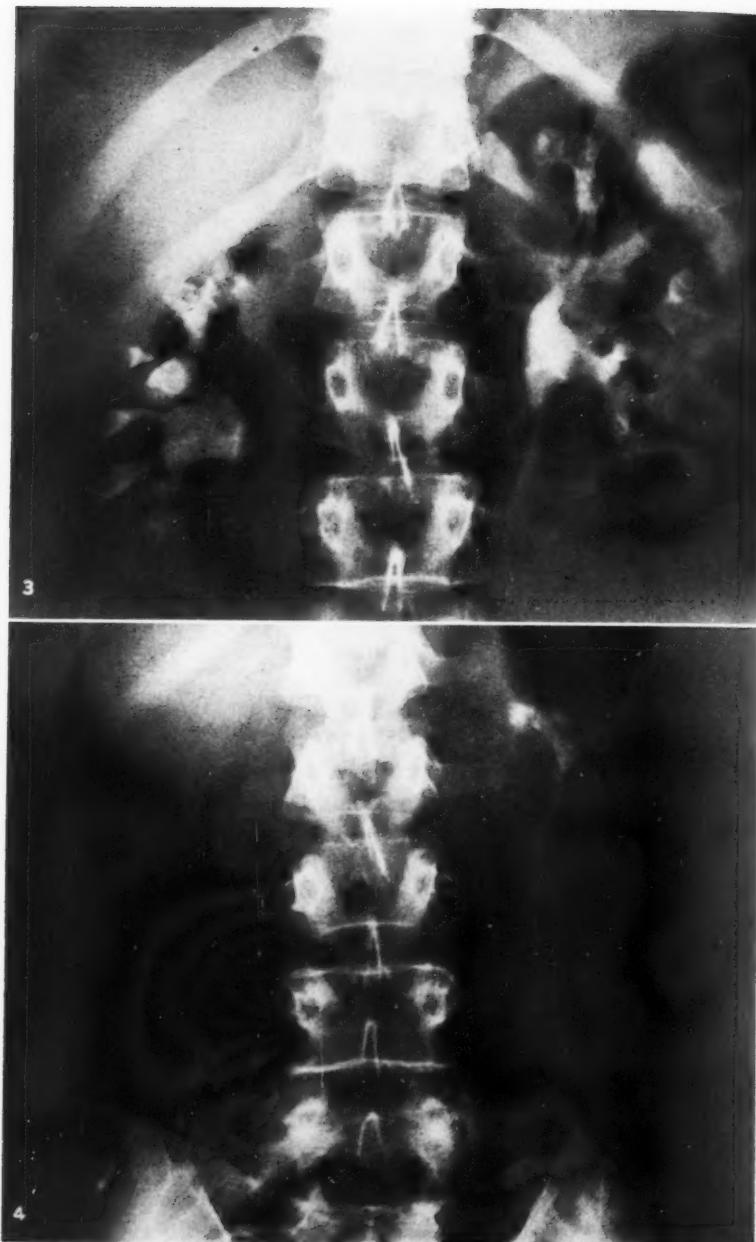


Fig. 3. Case I. Roentgenogram following the intravenous injection of 50 per cent Hypaque, demonstrating normal appearing calyceal system and pelvis, with the opaque medium outlining dilated structures (collecting tubules) containing calcific deposits.

Fig. 4. Case I. Upright roentgenogram after removal of compression and drainage of the calyceal system and pelvis; evidence of retention of opaque medium about the calcific deposits within the dilated collecting tubules.

tive. The preliminary film of the upper gastrointestinal examination showed areas of calcification superimposed on both renal areas—in the upper third of the right renal silhouette and the upper and lower poles of the left renal silhouette. In view of this finding, an intravenous pyelographic study was obtained. The stippled and nodular areas of calcification were found to occupy the region of the renal papillae of the calyceal system, involving the upper pole of the right kidney and the upper and lower pole of the left kidney. At this time the significance of the findings was not known to the radiologist (T. A. K.), and no conclusion as to the origin of these changes could be reached from the clinical course, physical examination, other roentgenograms, and laboratory results.

sisted after there had been partial drainage of the calyceal system with the patient in the upright position and with removal of abdominal compression (Fig. 4). It was now recognized that the findings corresponded to the condition described as medullary sponge kidney.

Laboratory studies on this date showed a normal blood count and routine urinalysis. Serum calcium was 10.6 mg. per cent; serum phosphorus was 3.2 mg. per cent; alkaline phosphatase was 1.2 Bodansky units; nonprotein nitrogen, 38 mg. per cent; serum chloride, 561 mg. per cent (96.1 mEq); serum sodium, 313 mg. per cent (136 mEq); serum potassium, 17.2 mg. per cent (4.4 mEq). The phenolsulfonphthalein test showed 39.6 per cent excretion in fifteen minutes and a total of 73.7 per

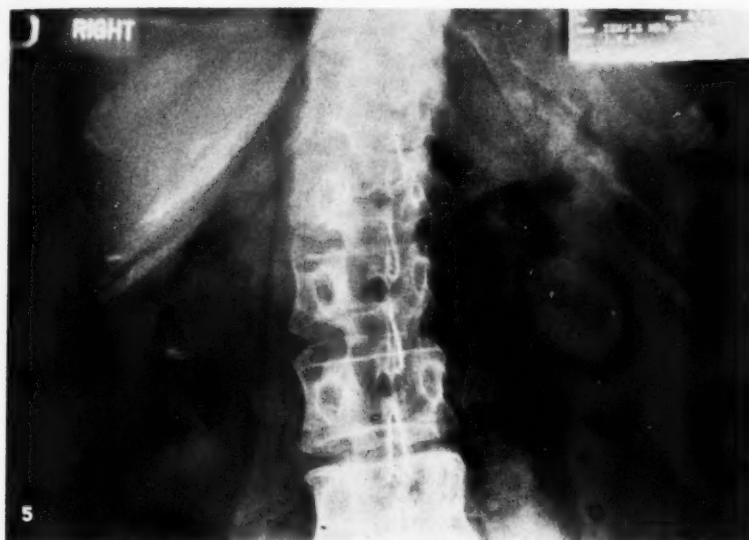


Fig. 5. Case II. Preliminary film of the abdomen demonstrating an area of calcification in the central portion of the right kidney and (on the original films) small areas of calcification in the upper pole of the left kidney, subsequently shown to lie within the renal papillae.

The patient was next seen on Feb. 3, 1960, because of diarrhea and pain in the right upper quadrant, related to respiration. A chest film was negative. A rib study revealed the calcifications observed earlier and led to further evaluation of the urinary tract. The repeated intravenous pyelographic study showed findings that were essentially identical with those enumerated for the examination in 1957. Again there were demonstrated the multiple calcifications in the upper pole of the right kidney, occupying an area  $1.2 \times 3$  cm.; in the upper pole of the left kidney, occupying an area  $3.0 \times 1.5$  cm.; and in the lower pole on the left,  $1.0 \times 1.8$  cm. (Figs. 1 and 2). The calcifications were further seen to be within dilated tubular structures in the pyramids of the involved portions of each kidney (Fig. 3), and opacification of these structures per-

cent in two hours. Fishberg concentration showed specific gravity of 1.006 on the first specimen of urine, 1.010 on the second specimen, and 1.012 on the third specimen.

**CASE II:** J. T., a 60-year-old white female, had been seen over a period of several years. She had a number of functional complaints, including hyperventilation syndrome with the onset of symptoms at about the time of the menopause. There were no symptoms referable to the urinary tract.

Laboratory studies disclosed normal blood chloride, sodium, potassium, calcium, and phosphorus levels. Urinalysis showed specific gravity of 1.017, with the other findings also normal. Hemoglobin was 13.0 gm. with a 40 per cent hematocrit.

Physical examination revealed mild hypertension,

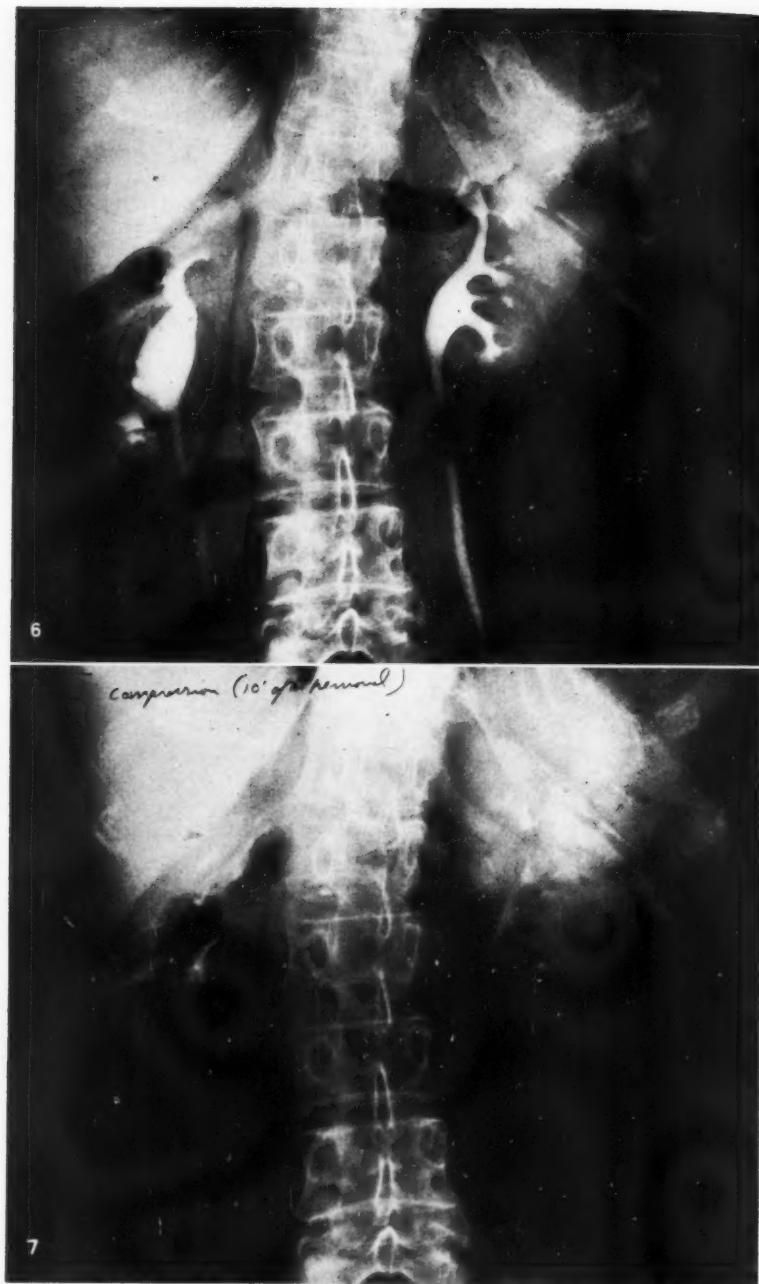


Fig. 6. Case II. Roentgenogram following intravenous injection of 50 per cent Hypaque, demonstrating normal appearance of the pelvis and calyceal system, but with the opaque medium outlining dilated structures in the pyramidal portions of some of the calyces, particularly the lower pole of the right kidney, representing dilated tubules in these areas.

Fig. 7. Case II. View ten minutes subsequent to removal of compression showing opaque medium still present in the involved pyramid in the dilated tubules.

the blood pressure being 160/90, but otherwise was essentially normal except for a retroverted uterus.

Intravenous pyelography was done on April 9, 1953, at which time the findings were essentially identical with the subsequent examination of Aug. 31, 1960, though their significance was not recognized on the earlier occasion. In 1960, small, poorly defined areas of calcification were demonstrated in each kidney, lying within the papillae. The changes on the right involved the midportion and lower pole and on the left the upper pole. Films subsequent to the intravenous injection of 50 per cent Hypaque showed prompt excretion and excellent concentration bilaterally, with retention of

of urinary stream. There was no previous history of genitourinary infections or injuries nor were any other genitourinary symptoms present. Recent left lower quadrant pain was attributable to sigmoid diverticulitis. Barium enema examination demonstrated diverticulosis of the proximal two-thirds of the sigmoid portion of the colon with some prominence of haustral pattern in the area involved.

The past history included an appendectomy in 1914 and cholecystectomy on Aug. 23, 1957, for cholelithiasis.

The physical findings with reference to the urinary tract indicated prostatic gland enlargement, Grade I. Abdominal examination was normal.



Fig. 8. Case III. Roentgenogram following intravenous injection of 50 per cent Hypaque demonstrating normal appearing calyceal system and pelvis bilaterally, with opaque medium outlining dilated tubules in the pyramidal portion of an upper pole calyx. Similar changes are probably present in two of the minor calyces of the midportion of the left kidney.

the opaque medium in many of the minor calyces and dilatation of tubules in the pyramidal portion of the kidney. These changes are particularly apparent in the lower pole and in one of the middle calyces of the right kidney and in the upper-pole calyces of the left kidney. The changes were essentially as demonstrated on the examination in April 1953 and were considered characteristic of medullary sponge kidney (Figs. 5-7).

**CASE III:** J. W., a 70-year-old white male, was seen Sept. 28, 1960, complaining of nocturia (two to four times) and progressive loss in size and force

There was a residual urine of 1/2 ounce. Intravenous pyelographic study was ordered as a part of evaluation of the patient.

Laboratory studies were as follows. Blood: total cholesterol 270 mg. per cent; blood count normal, with 14.1 gm. of hemoglobin and 44 per cent hematocrit. The nonprotein nitrogen was 47 mg. per cent. Urinalysis revealed specific gravity of 1.021 and was also essentially normal otherwise.

Intravenous pyelography on Sept. 29, 1960, showed renal silhouettes of normal size without observable calcification in either kidney. There was prompt excretion and good concentration of

opaque medium. Changes in the upper-pole calyces of the right kidney were interpreted as characteristic of medullary sponge kidney. Questionable changes involved at least one and probably two of the left midpole minor calyces also (Fig. 8).

#### DISCUSSION

No detailed discussion as to etiology of medullary sponge kidney will be included in this paper, as this has been adequately covered by others (1-4). Lindvall felt that it most likely resulted from failure of proper fusion of the collecting tubules of the wolffian duct anlage of the ureteral buds with the nephrogenic tissue. Vermooten, however, was of the opinion that the characteristic changes might be on the basis of uric acid deposits forming in the collecting tubules, leading to dilatation and subsequently to localized precipitation of calcium in these structures.

It appears from reviewing the literature that, as long as the collecting tubules remain uninjected and calcifications do not pass into the calyceal system, the patient will remain asymptomatic, and the condition will be compatible with a normal existence. By the same token, the usual circumstances leading to diagnosis are renal

calculi and renal infection. If infection occurs or the patient has repeated renal or ureteral calculi, cure can be effected by segmental removal of a portion of the involved kidney provided the process is localized.

#### CONCLUSION

Three cases of medullary sponge kidney have been recorded, the lack of case reports in the American literature being the basis for presentation of these. In Case I, there was a history of possible passage of a ureteral calculus several years previously; the other cases were essentially asymptomatic. The roentgenographic appearance is considered characteristic.

211 Cherry Ave.  
Long Beach 2, Calif.

#### REFERENCES

1. LENARDUZZI, G.: Reperto pielografico poco comune; dilatazione delle vie urinarie intrarenali. *Radiol. med.*, Torino **26**: 346-347, 1939.
2. VERMOOTEN, V.: Congenital Cystic Dilatation of the Renal Collecting Tubules; a New Disease Entity. *Yale J. Biol. & Med.* **23**: 450-453, June 1951.
3. MULVANEY, W. P., AND COLLINS, W. T.: Cystic Disease of the Renal Pyramids. *J. Urol.* **75**: 776-779, May 1956.
4. LINDVALL, N.: Roentgenologic Diagnosis of Medullary Sponge Kidney. *Acta radiol.* **51**: 193-206, March 1959.

#### SUMARIO IN INTERLINGUA

#### Ren a Medulla Spongiose: Roentgenodiagnose de Tres Casos

Ren a medulla spongiose es un condition in que le portion medullari de un o de ambe renes—partial- o totalmente—presenta un apparentia spongiose a causa del presentia de multiple micre cystes o cavitates que representa dilatate tubulos de collection e que pote continer o non continer depositos calcific. In certe casos le apparentia es illo de franc structuras cystic afficiente le pyramides; in altere casos, elongate e dilatate structuras tubular es vidite. Un typic constatacion es le retention del sub-

stantia opac durante un plus longe tempore in iste structuras que in le sistema calyce.

Il pare ab un revista del litteratura que si longo que le tubulos remane sin infection e durante que calcificationes non passa ad in le sistema calyce, le paciente remane asymptomatic e le condition es compatible con un existentia normal.

Tres casos diagnosticate roentgenographicamente es addite al pauc casos que figura in le litteratura american.

The Re

THIS I  
T undi  
roid treat  
of exten  
mediasti  
sible, sin  
incomple  
the entire  
interest  
because  
them m  
was poss  
from thi  
in 1950.  
divided i  
cinomas  
was 20  
treated t  
2-Mev r  
tried to g  
r. In the  
in terms  
to 6,000  
many p  
not rece  
poor gen  
peripher  
during  
the seri  
Marks  
Hospital  
outside  
pattern  
of 175 n  
neck, su  
perior m  
in most

Many  
histolog  
resented  
For th

<sup>1</sup> From  
The New  
of the Rad

# The Results of X-Ray Treatment in Undifferentiated Carcinoma of the Thyroid<sup>1</sup>

MAGNUS I. SMEDAL, M.D., and WILLIAM A. MEISSNER, M.D.

THIS IS A PRESENTATION OF 44 CASES OF undifferentiated carcinoma of the thyroid treated by 2-Mev radiation. Because of extensive invasion of the neck and mediastinum, surgical cure was not possible, since resections, if attempted, were incomplete. The pathologic findings in the entire group have been reviewed. Our interest in these patients has continued because of our present ability to treat them more vigorously with x-rays than was possible at the time of the last report from this clinic by Hare and Salzman (1) in 1950. In that report the tumors were divided into small-cell and giant-cell carcinomas and the five-year survival rate was 20 per cent. Since 1949 we have treated the majority of these patients with 2-Mev radiation and when possible have tried to give a minimum tissue dose of 4,800 r. In the earlier report the dosages were all in terms of air dose, ranging from 4,800 to 6,000 r (in air). For various reasons many patients in the present series did not receive 4,800 r, some because of their poor general condition and others because peripheral metastases became apparent during the treatment period. Three of the series were treated by Dr. Joseph Marks at the New England Deaconess Hospital, Boston, and 3 were treated outside of Boston. Our present treatment pattern has been to deliver a tissue dose of 175 r per day, five days a week, to the neck, supraclavicular areas, and the superior mediastinum, with a goal of 4,800 r in most and 6,000 r in some cases.

## PATHOLOGY

Many of the specimens removed for histologic examination in these cases represented only biopsies or partial excisions. For this reason, an adequate and con-

sistent evaluation of the gross features of the various types of undifferentiated carcinoma was not feasible. When sufficient tissue was available for gross study, the appearance generally was that of obvious carcinoma with evident invasion of adjacent structures. In some cases, the gross differential diagnosis included the possibility of chronic thyroiditis. Again, because so much of the material consisted only of biopsy specimens, an evaluation of the microscopic changes in those portions of the gland uninvolved by tumor was incomplete. Although many of the specimens microscopically showed chronic thyroiditis in addition to tumor, whether this was a pre-existing condition or the result of the presence of the neoplasm could not be determined.

Histologically these tumors have in common an undifferentiated, solid growth pattern, with few or no elements of a follicular or papillary nature. Microscopically there are four major subgroups which are readily distinguishable from one another. In addition, mixtures of these undifferentiated subtypes or even follicular or papillary foci, or both, were sometimes seen; such cases were placed in a fifth category of "mixed" cancers. Since detailed pathologic descriptions of undifferentiated thyroid carcinomas have been published elsewhere (2), only a brief description of each of the subtypes will be given. The tumors are listed in descending order of estimated malignancy based on histologic appearance.

*Giant-cell Carcinoma (Fig. 1):* Giant-cell cancer is distinguished by the extreme anaplasia of its cells and particularly by the presence of numerous giant cells, multinucleated cells, and mitoses. The overall appearance is that of a high grade

<sup>1</sup> From the Department of Radiology, Lahey Clinic, Boston, Mass. (M. I. S.) and the Department of Pathology, The New England Deaconess Hospital, Boston, Mass. (W. A. M.). Presented at the Forty-sixth Annual Meeting of the Radiological Society of North America, Cincinnati, Ohio, Dec. 4-9, 1960.

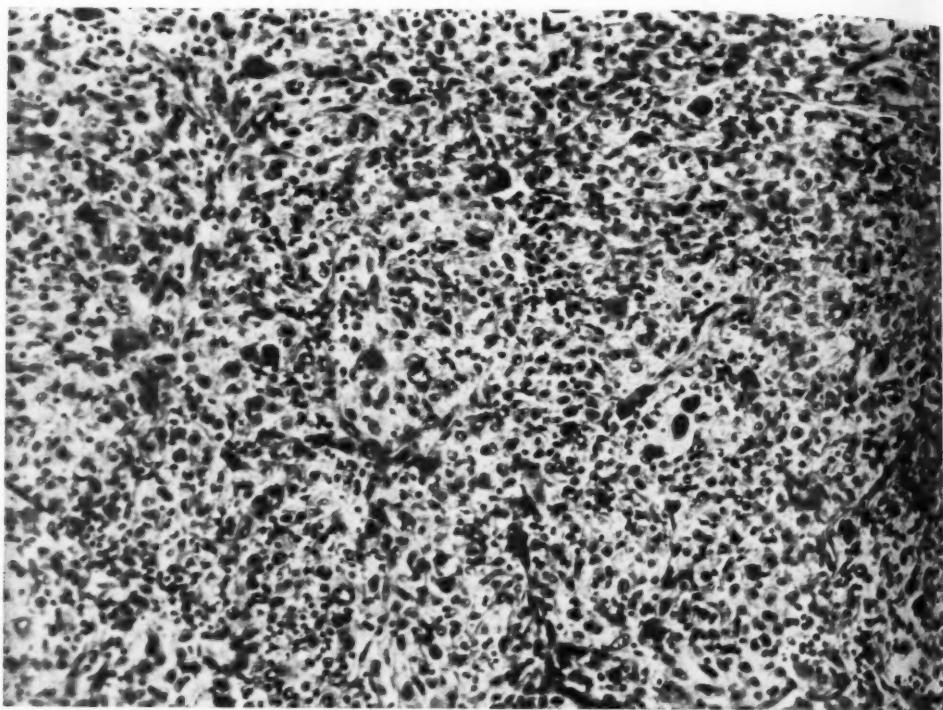


Fig. 1. Giant-cell carcinoma with numerous large multinucleated cells and frequent mitoses. Some of the cells are spindle-shaped to suggest sarcoma.

of malignancy often so anaplastic that in some foci it is difficult to be certain whether the tumor is carcinoma or sarcoma.

*Small-cell Diffuse Carcinoma (Fig. 2):* In small-cell diffuse carcinoma, as the name suggests, the cells are smaller than those of the normal thyroid epithelium. They show only moderate pleomorphism; mitoses are frequent. The tumor grows diffusely in sheets and extends in this fashion into adjacent thyroid tissue and muscle. The appearance is suggestive of lymphosarcoma, and the distinction from that neoplasm can often be made with certainty only when definite epithelial foci can be identified.

*Small-cell Compact Carcinoma (Fig. 3):* While the cells in this tumor are also small, they are of a more uniform size and show fewer mitoses than in the types previously mentioned. A characteristic feature is the clustering of the tumor cells into compact groups. Another common

finding is a prominent fibrous hyaline stroma often resembling amyloid and staining as such (3). This stroma, however, was not found in all tumors of this type and, even when it was present, its distribution was sometimes only focal.

*Cuboidal-cell Carcinoma (Fig. 4):* In cuboidal-cell carcinoma, the average size of the cells is about that in follicle epithelium, but with an absence of follicle formation. Variations to a columnar or polygonal shape exist. Mitoses are infrequent. The tumor cells and growth pattern often resemble those of a trabecular or embryonal adenoma. Invasion of adjacent thyroid and neck structures, however, is extensive.

*Mixed Carcinoma (Fig. 5):* Tumors showing mixtures of the foregoing types, even with follicular or papillary foci, were placed in the category of mixed carcinoma. In some of these, four or five different growth patterns were observed. More specific

classifi-  
wise si-  
there w-  
potenti-

We  
thyroid

Stage I  
Stage II

Stage I

Stage I

All 4  
of Stag-  
had in-  
both,

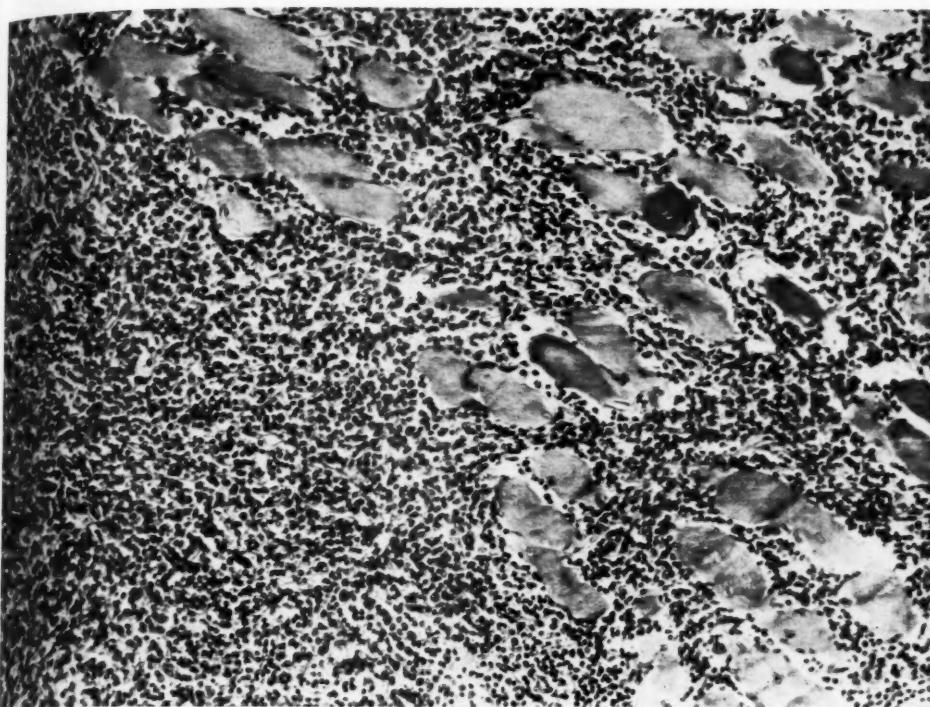


Fig. 2. Small-cell diffuse carcinoma. The small size of the tumor cells and the diffuseness of the tumor suggest lymphoma. Note the massive infiltration into striated muscle in right half of illustration.

classification of these tumors seemed unwise since from the histologic appearance there was no way to predict their growth potential.

#### DISCUSSION

We have classified carcinoma of the thyroid into four stages as follows:

- Stage I..... Confined to 1 lobe
- Stage II..... Involvement of 1 lobe with nodes on one side
- Stage III..... Involvement of both lobes with or without nodes
- Stage IV,A..... Invasion of neck or mediastinum
- Stage IV,B..... Distant metastases

All 44 cases reported in this paper were of Stage IV,A: In all cases the carcinoma had invaded the neck, mediastinum, or both, and was not curable by a surgical

procedure. The extent of the disease in these cases is well shown in Table I.

TABLE I: SURGICAL EVALUATION OF 44 CASES OF CARCINOMA OF THE THYROID

	Inoperable	Incomplete	Tracheostomy	Recurrent Nerve Paralysis
Giant-cell	4	11	9	4
Small-cell diffuse	6	6	8	1
Small-cell compact	4	3	3	2
Cuboidal-cell	0	2	1	0
Mixed	6	2	3	3

In the giant-cell group, 4 patients had recurrent nerve paralysis, and 9 needed tracheostomy because of tracheal obstruction. Four cases were completely inoperable, and in the remaining 11 cases none of the carcinomas was completely eradicated by surgery. Cervical nodes were involved in 25 per cent of this group (Table II).

From a surgical standpoint, small-cell

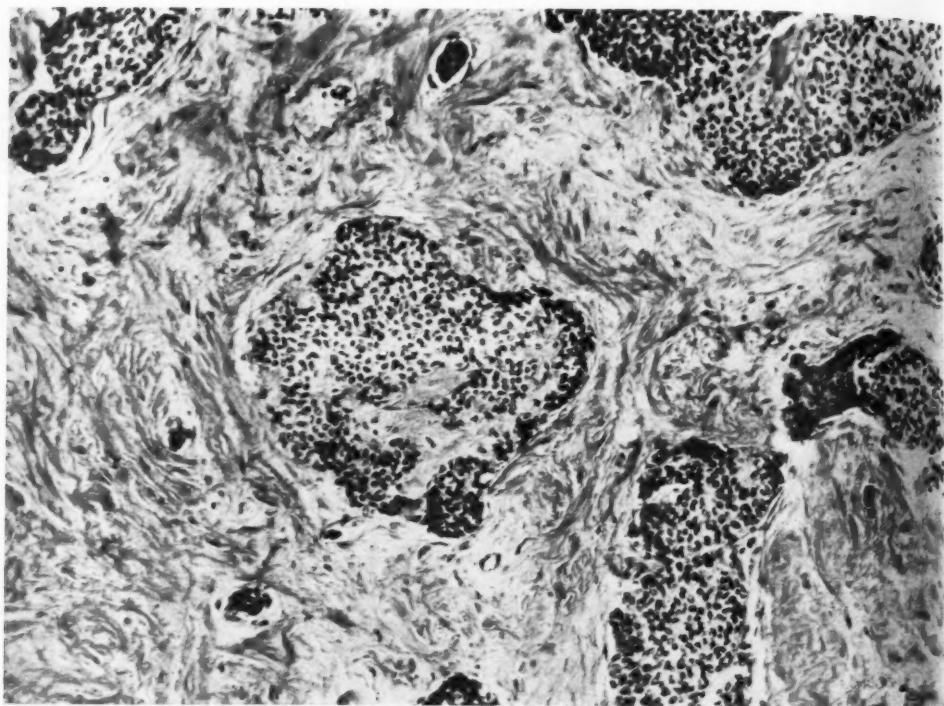


Fig. 3. Small-cell compact carcinoma. The small tumor cells are growing in irregular clusters of various sizes and are surrounded by a dense hyaline stroma. Note invasion of lymphatic vessel by tumor at upper center of illustration.

TABLE II: INVOLVEMENT OF NECK NODES, AVERAGE DURATION OF SYMPTOMS BEFORE DIAGNOSIS, AVERAGE AGE, AND SEX OF 44 PATIENTS WITH UNDIFFERENTIATED CARCINOMA OF THE THYROID

No. of Cases	Involvement of Neck Nodes Pathologically and Clinically	Average Duration of Symptoms Before Diagnosis (months)	Average Age		Sex	
			—Male	Female	—Male	Female
Giant-cell	15	4	2½	60	10	5
Small-cell diffuse	12	1	6	66	1	11
Small-cell compact	7	6	16	62	5	2
Cuboidal-cell	2	0	66	78	1	1
Mixed	8	4	4	57	4	4*

\* One patient in this group was five years old.

diffuse involvement is even more hopeless; 6 of the 12 cases were completely inoperable. Eight patients required tracheostomy. A frequent statement in the surgical note was "tracheostomy was done with difficulty." These tumors are very invasive and, as they grow, they obliterate normal tissue planes, making dissection extremely difficult, if not impossible. Local metastases in the neck occur very infrequently; they were present in only 1 of the 12 cases.

The less common small-cell compact carcinoma is much more benign, but in our inability to cope with it surgically it is similar to the other two groups. Two patients had recurrent nerve paralysis, 3 required tracheostomy, and none of these was curable in the opinion of the surgeons. In 2 cases the carcinomas were grossly resectable, but tumor tissue was left behind. Perhaps carcinomas of this type could be resected more often because of their predilection to extend along tissue

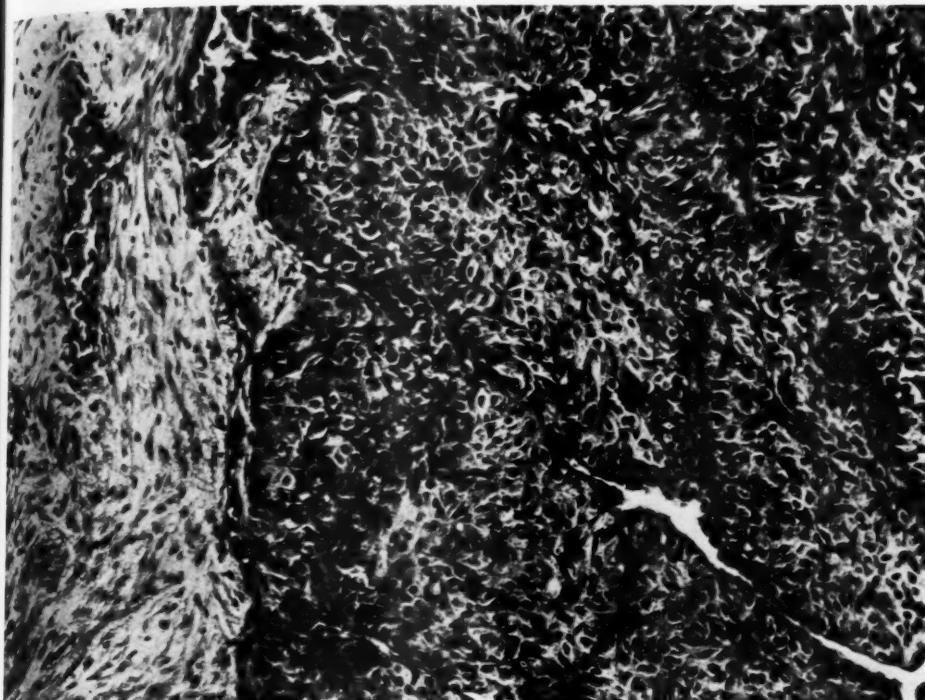


Fig. 4. Cuboidal-cell carcinoma. The tumor appears glandular, but the cells do not form follicles. Blood vessel at left is invaded by tumor.

planes without actually invading tissue, in contrast to the small-cell diffuse type, in which all normal cleavage planes are destroyed. The small-cell compact group, however, is not completely amenable to surgery, because the tumors extend so deeply into the neck and mediastinum that they become technically impossible to remove. A number of the surgical notes convey the impression that, as these tumors grow, they split the cleavage planes without infiltrating the tissue and grow in sheets into the neck and mediastinum. Because of their ramifications, they are not curable surgically. The small-cell compact types frequently metastasize to the cervical region (Table II).

Two cases in this series belong in the cuboidal-cell group. In 1 the trachea was invaded by tumor and surgical cure was therefore not possible; in the second patient, involvement was widespread and extended deeply into the mediastinum,

much as in the small-cell compact type. The tumor in the second case was grossly removed, but the surgeon thought he had left behind some neoplastic tissue. Neither of these 2 patients had metastases to the neck, and both are living and well five and eight years after x-ray therapy. One received only 3,200 r with 400 kv technique, and the other received 6,000 r at 2 Mev. The large dose was used in the second case because of our past unhappy experiences with lower dosages.

Last is the group of mixed tumors. The average survival time in 8 cases was forty-two months, with a range of four to one hundred and eight months. We were able to control the neck tumor except in 1 case, in which the carcinoma recurred locally eight months after a tissue dose of 4,800 r. As a group these tumors are unpredictable. The photomicrographs in Figure 5, showing several distinct tumor types, are from a case with a survival of

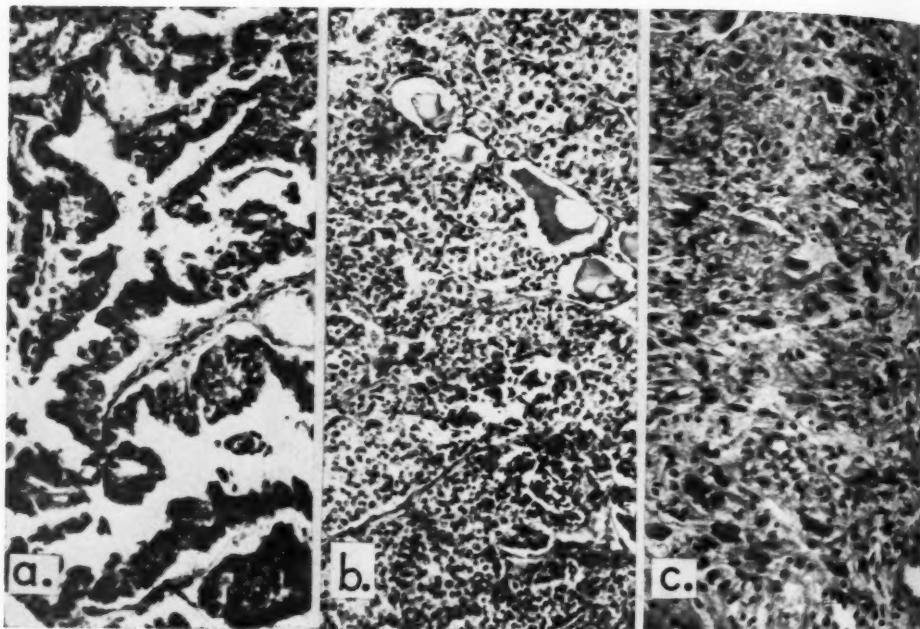


Fig. 5. Mixed carcinoma. This tumor shows a mixture of three elements with papillary foci (a), small-cell foci (b), and giant-cell carcinoma (c).

only four months after biopsy and resection of the thyroid isthmus to facilitate tracheostomy. Widespread metastases and local involvement occurred despite a tissue dose of 4,800 r. From biopsy only, it is impossible to state which type predominates in these mixed tumors, and it seems reasonable to base the prognosis on the predominating cell type.

#### DURATION OF SYMPTOMS BEFORE DIAGNOSIS

In Table II the groups are arranged so that the first listed appears pathologically to be the most malignant. Column 4 of this table shows the length of time symptoms were present before diagnosis was made. The duration of symptoms before the patients sought medical advice was shortest in those with the most malignant tumors. Of the giant-cell tumors, 5 were found in patients in whom nodules or goiter were known to have existed two, two, four, eight, and forty years, respectively, before the acute symptoms of pain, hoarseness, or sudden growth with pressure

symptoms occurred. This finding in the giant-cell group was mentioned previously by Hare and Salzman.

#### AGE AND SEX

The average age for this group of 44 patients was sixty years. Meissner and McManus (4) reported an average age of fifty-eight years in a total of 46 patients with undifferentiated tumors of the thyroid; 74 per cent were females. In the report by Hare and Salzman, the average age of patients with small-cell carcinomas was 46.5 years, and of those with giant-cell carcinomas 59.4 years. Hare and Salzman also reported that females predominated 6 to 1 and 8 to 1, respectively, in the two groups. In the present series, males predominated in the giant-cell group 2 to 1 and in the small-cell compact group 5 to 2; but in the small-cell diffuse group there were 11 females and only 1 male (Table II).

#### SURVIVAL AFTER X-RAY TREATMENT

The present pathologic grouping fits well with some of the clinical character-

Giant-cell  
Small-cell  
Small-cell  
Cuboidal-cell  
Mixed

Giant-cell  
Small-cell  
Small-cell  
Cuboidal-cell  
Mixed

istics which carcinomas should have. The surgeon relatively the 7 patients cell component more often at operation grossly but do not show diffuse do not early, the rapid and only 1 of and only tumors Table I and is a these are

DEGRE  
Aside  
need to  
respond  
that 7 o  
of the th  
after dos  
In the o  
static d  
the necl

TABLE III: LENGTH OF SURVIVAL AFTER DEFINITIVE DIAGNOSIS

	Cases	One Year	Three Years	Five Years
Giant-Cell	15	2	1	1
Small-cell diffuse	12	4	1	1
Small-cell compact	7	6	5	4
Cuboidal-cell	2	2	2	2
Mixed	8	6	4	2

TABLE IV: SURVIVAL TIME

	Average (months)	Range (months)
Giant-cell	6	1-18 (1 case, 10 years)
Small-cell diffuse	13	4-72
Small-cell compact	52	8-121
Cuboidal-cell	60 and 96	2 patients alive and well
Mixed	42	4-108

istics which help to differentiate thyroid carcinomas. These clinical characteristics should be of some importance to the surgeon in helping to decide and select the relatively radiosensitive groups. Four of the 7 patients with carcinomas of the small-cell compact type are alive five years or more after treatment. It might be possible at operation to distinguish these tumors grossly by the fact that they ramify into, but do not invade, the tissue planes. They show distinct sensitivity to radiation but do not have the tendency to metastasize early, displayed by the other groups. For the rapidly growing giant-cell and small-cell diffuse types the survival time is short; only 1 of 15 patients with giant-cell tumors and only 1 of the 12 with small-cell diffuse tumors survived five years (Table III). Table IV shows the average survival, and is another way of demonstrating that these are distinct pathologic groups.

#### DEGREE OF CONTROL OF LOCAL TUMOR

Aside from the actual survival time, we need to know whether or not these tumors respond to x-ray therapy. Table V shows that 7 of 15 cases of giant-cell carcinoma of the thyroid recurred locally in the neck after dosages ranging from 1,000 to 6,000 r. In the other 7 patients who died of metastatic disease, evidence of recurrence in the neck was not present over a period

TABLE V: CONTROL OF DISEASE IN NECK

	Total Cases	Recurrence
Giant-cell	15	7 in 2-7 months (doses: 1,000; 2,000; 2,800; 4,800; 5,100; 6,000 r)
Small-cell diffuse	12	1 at 30 months (dose: 2,400 r in air) 4 failures (doses: 1,500; 3,600; 3,800; 4,200 r in air)
Small-cell compact	7	1 at 30 months (dose: 6,000 r) 1 at 8 months (dose: 6,000 r)
Cuboidal-cell	2	None—5 and 8 years
Mixed	8	1 at 8 months (dose: 4,800 r)

varying from two to eighteen months after treatment. In 1 case treatment was stopped after a dose of 3,000 r because metastasis was discovered; this patient died six weeks later from widespread metastatic disease. At autopsy residual tumor was found in the neck but the pathologic section showed marked radiation effect, indicating sensitivity. The other patients in this group received 4,800 r and 1 was given 6,000 r.

In the group with small-cell diffuse carcinoma immediate local failures resulted in 5 of the 12 cases. In 1 case there was a recurrence thirty months after an air dose of 2,400 r had been given; this patient was treated elsewhere. In 4 cases the tumor recurred or persisted after dosages of 1,500, 3,600, 3,800, and 4,200 r. In the last-mentioned case treatment was given elsewhere, and the dosage was stated in terms of air dose. We believe that these patients were undertreated. In the small-cell compact group 3 patients failed to survive five years. One died of metastatic disease at twenty-one months, with no evidence of disease in the neck after a tissue dose of 4,800 r. The other 2 had recurrences in the neck with liver and pulmonary metastases after 6,000 r tissue dose. We cannot account for such a different response in these 2 cases except to speculate that other elements of a more malignant type may perhaps have been present. We wish to stress again that in these cases, particularly the last 2, the tumors were not surgically resectable, and therefore only tissue samples were available for pathologic study.

The results in the group with mixed-tumor cells are encouraging in that only 1 patient had a recurrence at eight months after a tissue dose of 4,800 r. The carcinoma was controlled in the neck for eighteen months in 1 case with 3,500 r, and for four, six, and nine years in 3 cases after a dose of 4,800 r. The last patient in this group received 6,000 r and survived three years with no recurrence; death was the result of an accident.

#### DOSAGE

A tissue dose of 5,000 r in five to six weeks appears to be sufficient for the small-cell compact type of carcinoma. This is not difficult to achieve even though the entire neck, the supraclavicular areas, and the superior mediastinum are treated in one rotational field. There is a reasonable chance to control the disease locally with this dosage, and we will probably continue using it although control has been obtained with smaller amounts.

The same may be true for most mixed tumors. Because of the mixture of cells and our inability to tell which type is predominant, however, we may be under-treating at 5,000 r. Since mixed tumors are likely to contain elements that metastasize to the cervical nodes, the field must necessarily remain rather large.

When the two most malignant types are considered, it is our belief after this survey that some changes may be made in technic. First, the field can be made smaller since the small-cell diffuse type does not show a tendency to metastasize to the cervical nodes. In the giant-cell tumors, in 25 per cent of which metastases occur, the nodes are adjacent to the main thyroid mass and not widely spread in the neck, as in papillary and follicular carcinoma. With a smaller field, tissue doses of 6,000 r can be delivered routinely. Of further aid in x-ray therapy is the fact that in recent years surgeons have performed only biopsy and palliative resections of tumor in patients with these undifferentiated carcinomas. With less

surgical trauma, the reaction from roentgenotherapy is also diminished.

#### SUMMARY

A series of 44 cases of undifferentiated carcinoma of the thyroid is analyzed. In all the disease was too far advanced to be surgically curable. The primary therapy was external radiation, usually with 2-Mev x-rays.

A subdivision into four basic pathologic types is shown to coincide with the clinical behavior and response to external irradiation.

The Stage IV giant-cell and small-cell diffuse types show little promise of control by external irradiation because of their marked and early invasiveness and tendency to early peripheral metastasis.

The small-cell compact carcinoma is relatively sensitive to irradiation and less malignant than the above two types. It tends to metastasize locally, spreading along tissue planes, and may ramify widely in the neck and upper mediastinum. Four of 7 patients with Stage IV tumors have survived five years or more after doses of 3,000 to 6,000 r.

The cuboidal-cell type is the most benign of the undifferentiated carcinomas of the thyroid.

Many tumors are of mixed pathologic types. Survival of patients with such carcinomas probably is determined by the predominant cell type. Control of the lesion in the neck can be achieved.

605 Commonwealth Ave.  
Boston 15, Mass.

#### REFERENCES

1. HARE, H. F., AND SALZMAN, F. A.: Cancer of the Thyroid: Ten to Twenty Year Follow-Up. *Am. J. Roentgenol.* **63**: 881-887, June 1950.
2. WARREN, S., AND MEISSNER, W. A.: Tumors of the Thyroid Gland. *Atlas of Tumor Pathology, Section IV, Fasc. 14.* Washington, D. C., Armed Forces Institute of Pathology, 1953.
3. HAZARD, J. B., HAWK, W. A., AND CRILE, G., JR.: Medullary (Solid) Carcinoma of the Thyroid; A Clinicopathologic Entity. *J. Clin. Endocrinol.* **19**: 152-161, January 1959.
4. MEISSNER, W. A., AND McMANUS, R. G.: A Comparison of the Histologic Pattern of Benign and Malignant Thyroid Tumors. *J. Clin. Endocrinol.* **12**: 1474-1479, November 1952.

## SUMMARIO IN INTERLINGUA

## Resultados de Therapia a Radios X in Non-Differentiate Carcinoma del Glandula Thyoide

Quaranta-quatro casos de non-differentiate carcinoma de glandula thyoide, esseva tractate primariamente con radiaction externe, usualmente con radios X de 2 Mev. Le tumores es listate in ordine descendente secundo lor estimate malignitate super le base del structura histologic: Cellulas gigante, diffuse cellulas micre, compacte cellulas micre, cellulas cuboide, e carcinoma mixte. Iste classification corrisponde al comportamento clinic e al responsivitate sub irradiation externe.

Le typos a cellulas gigante e a diffuse cellulas micre in stadio IV monstra pauc promissa de ceder sub irradiation externe a causa de lor marcate e precoce invasivitate e lor tendentia de formar metastases precoce e peripheric.

Le carcinoma compacte a micre cellulas es relativemente sensibile pro irradiation e minus maligne que le supra-mentionate typos. Illo tende a metastasar se localmente, extendente se al longo de planos tissular, e pote ramificar se extensemte in le collo e le mediastino superior. Quatro inter 7 patientes con tumores de stadio IV superviveva cinque annos o plus post doses de 3.000 a 6.000 r.

Le typo a cellulas cuboide es le plus benigne inter le non-differentiate carcinomas del thyoide.

Multe tumores es de mixte typos pathologic. Le supervivencia de patientes con tal carcinomas es probabilmente determinate per le predominante typo cellular. Contenir le lesion in le collo es possibile.



# Localizing the Placenta with Radioactive Iodinated Human Serum Albumin<sup>1</sup>

FRED C. HEAGY, M.D., and DONALD P. SWARTZ, M.D.

LOCALIZATION OF the placenta is important in the management of the obstetric patient with third trimester antepartum bleeding. At some stage of management, usually after bleeding has ceased for twenty-four to forty-eight hours, careful speculum examination may disclose local causes, and such patients can be spared further investigation. For the remainder, a number of methods of excluding *placenta praevia* have been proposed, as indicated in Table I.

TABLE I: METHODS OF PLACENTAL LOCALIZATION

Clinical: Vaginal palpation (in operating theatre)	
X-ray direct methods	
Intravenous.....	Ehrhardt, K., 1932
Soft-tissue.....	Snow, W., and Powell, C. B., 1934
Tomography.....	Lloyd, O., and Samuel, E., 1941
Intra-arterial	
Aortic.....	Hartnett, L. I., 1948
Femoral.....	Sutton, D., 1952
X-ray indirect methods	
Direct amniography.....	Holly, L. E., Menees, T. O., and Miller, J. D., 1930
Contrast	
Bladder.....	Ude, W. H., and Urner, J. H., 1938
Bladder and rectum.....	Sohrne, G., 1942
Displacement.....	Golden, R., and Ball, B. P., 1941
Radioactive isotopes	
Sodium ( $Na^{24}$ ).....	Browne, J. C. M., and Veall, N., 1950, 1951
Albumin ( $I^{131}$ ).....	Weinberg, A., Rizzi, J., McManus, R., and Rivera, J., 1957

Regrettably, all of the roentgenologic procedures for placental localization are attended by disadvantages, and for that reason we have been interested in the application of radioactive isotopes to this problem. The first placental localization by means of a radioactive isotope was reported by Browne and Veall (1, 2) in 1950. Radioactive sodium ( $Na^{24}$ ) in saline solu-

tion was injected intravenously to locate anterior placentas in order to aspirate maternal placental blood for research studies. Isotopic methods of placental localization depend on the fact that the placenta contains a pool of maternal blood, which, radioactive, may be detectable. Radioactive sodium diffuses out of the blood stream so rapidly that counting has to be completed very quickly, and relatively high levels of radioactivity are needed. Human serum albumin labeled with radioactive iodine, however, is retained in the maternal blood stream. The use of this agent was first reported by Weinberg and his associates (3) in 1957, although they had suggested it a year earlier (4). Further experience using radioactive isotopes for placental localization is recorded by various authors (5-9).

## METHOD

Three microcuries of radioactive iodinated ( $I^{131}$ ) human serum albumin is injected into the antecubital vein. Fifteen minutes is allowed for distribution of the material in the maternal circulation and the patient is then placed in the supine position. The fetal position and the height of the fundus above the symphysis pubis are recorded. A scintillation detector with a  $1 \times 1$ -inch crystal with lateral shielding and anterior collimation, but with no filter in front of the crystal, is used. It is mounted in a Nuclear Chicago model SA2 detector stand which permits rapid positioning.

With the detector connected to a count rate meter (Fig. 1), the radioactivity is counted in a reference position over the precordium and in 21 positions around the

<sup>1</sup> From the Ontario Cancer Foundation London Clinic, Victoria Hospital, and the Department of Obstetrics and Gynaecology, University of Western Ontario, London, Ont., Canada. Presented at the Forty-sixth Annual Meeting of the Radiological Society of North America, Cincinnati, Ohio, Dec. 4-9, 1960.

A preliminary report was presented at the Twenty-ninth Annual Meeting of the Royal College of Physicians and Surgeons of Canada, Montreal, P.Q., Jan. 21-23, 1960. This project was supported by the Child and Maternal Health Grant #605-13-30, Department of National Health and Welfare, Canada.

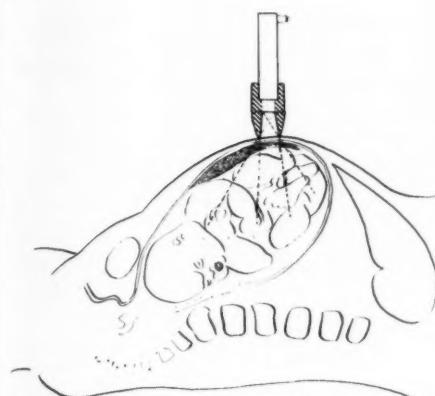


Fig. 1. Schematic illustration of the method of placement of scintillation detector to obtain radioisotope localization of the placenta.

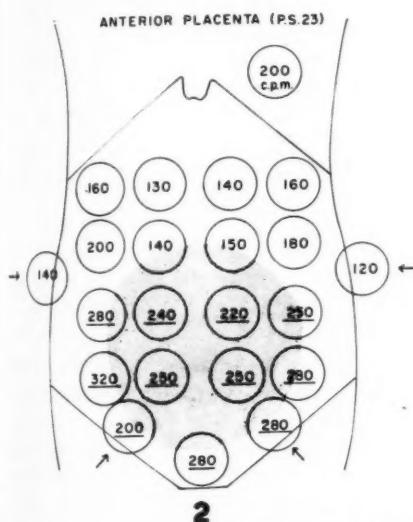


Fig. 2. A central anterior wall placental location confirmed at cesarean section. Readings are shown in counts per minute (c.p.m.) as read from count rate meter.

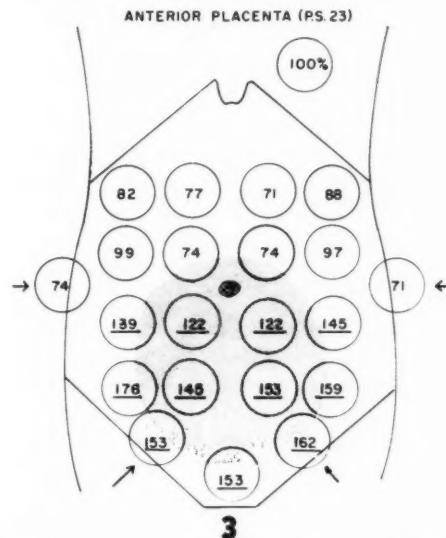
Fig. 3. Same patient as in Fig. 2 but with readings calculated on the basis of 100 per cent for the precordial value.

uterus, the counts being recorded on a schematic diagram (Fig. 2). Sixteen of the counting positions are over the anterior abdominal wall, in two rows above and two rows below the umbilical level. To obtain these readings the detector is positioned with the front of the collimator flush with the patient's skin and aligned so that the detector axis is perpendicular to the skin surface at the point of reading. A lateral reading is taken in each flank with the

detector in a horizontal position so that it can pick up radioactivity from the posterior aspect of the uterus. Readings are also taken at the midpoint of each inguinal ligament and at the symphysis pubis, with the detector directed toward the cervix. Two or more readings are made at each position and the mean values are calculated. To minimize the uptake of  $I^{131}$  by the thyroid gland, Lugol's solution is prescribed daily for two weeks following the test and preferably also for two days preceding it.

#### CLINICAL MATERIAL

Forty-two patients have been examined for placenta praevia by injection of  $I^{131}$



human serum albumin. Their clinical status was as follows:

Pre-cesarean	15
Vaginal bleeding	13
Normal pregnancy	9
Intra-uterine death	5
Twins	1
TOTAL	42*

\* One patient listed in two categories.

Since 1 patient was in 2 groups, the total for the different groups is actually more

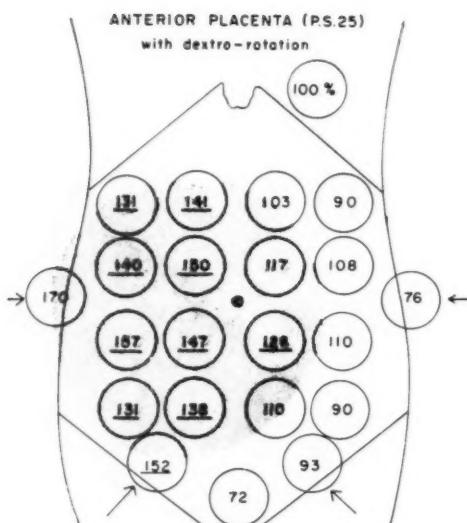


Fig. 4. Dextro-rotation of the uterus was reflected in the values obtained by this method.

than 42. Confirmation of placental localization was by visualization and/or palpation at cesarean section, or by immediate intrauterine palpation following vaginal delivery.

#### RESULTS

Figure 2 shows the actual counts per minute over one patient. An area over the precordium was used as a reference position. In this case the placenta lay on the anterior uterine wall, as indicated by the shaded area, extending almost to the fundus superiorly, while inferiorly it lay just above the line of a low transverse segment cesarean incision. Although high counts were obtained in the lower segment area, this patient did *not* have placenta praevia. Her complete counts, averaged and calculated as a percentage of the count in the precordial area, are shown in Figure 3. In the diagrams that follow, the information is presented in this way, *i.e.*, the average results are expressed as a percentage of the precordial counts.

The next case (Fig. 4) demonstrates an anterior placental location with considerable dextro-rotation of the uterus. At cesarean section the placenta extended from just below the fundus to just above

the lower segment transverse incision. On this scan, only one of the lowermost abdominal readings (152) is elevated.

Figure 5 is a pre-cesarean study showing a placenta located for the most part posteriorly but extending around the left lateral aspect of the uterus and onto a por-

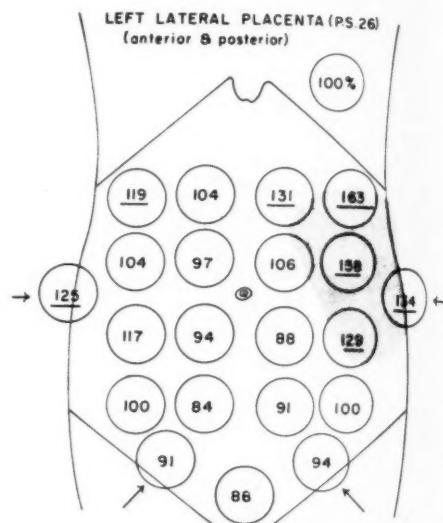


Fig. 5. The elevated right lateral reading of 125 per cent is consistent with the posterior location of most of the placenta in this case.

tion of the left anterior surface, particularly superiorly. This example demonstrates the value of the lateral counting positions as an aid in locating placentas which lie posteriorly. Note the 125 per cent reading in the right lateral position.

The uniformly low values which may be obtained when the placenta lies directly posteriorly are illustrated in Figure 6. It is interesting that in this study, in which the placenta was located exactly mid-posteriorly, neither of the lateral readings was high.

The results obtained in this series are summarized in Table II. In 14 cases no anatomical diagnosis of placental position was obtained. In 16 of the 17 cases in which there was direct visualization and/or palpation at cesarean section, location had been determined correctly by the isotopic method. In 11 patients final confirma-

TABLE II: RESULTS OF ISOTOPIC PLACENTAL LOCALIZATION

Method of Confirmation	Correct	Qualified*	Incorrect	Total
Caesarean section	16	1	0	17
Intra-uterine palpation after vaginal delivery	10	1	0	11
	26	2	0	28
Confirmation not obtained				14
<b>TOTAL</b>				<b>42</b>

\* Level confirmed but site of attachment not predicted fully (see text).

tion of placental position was by intra-uterine palpation after vaginal delivery; in 10 of this number the isotopic localization was fully confirmed. In 1 patient with vaginal delivery and in 1 with cesarean section, there was qualified agreement between the isotopic indications and the final diagnosis of placental location. Both these women had third trimester bleeding. In the patient who underwent cesarean section the isotope procedure suggested a placenta lying on the right side and posteriorly, at the mid-segment level, and extending into the lower segment. Some degree of *placenta praevia* was considered a possibility. At operation the placenta was found on the right and posteriorly and there actually was a partial *placenta praevia*. This patient had also been examined radiologically for placental location and the x-ray interpretation suggested a position in the fundus on the right. In the other patient the isotope procedure indicated a placenta lying in the lower segment on the right side and somewhat posteriorly. After vaginal delivery, with further bleeding, the obstetrician palpated the placenta within the uterus and diagnosed its location as in the lower segment, but anteriorly and toward the left side.

#### DIFFERENTIAL DIAGNOSIS OF PLACENTA PRAEVIA

In 15 patients the possibility of a *placenta praevia* was suspected: there was vaginal bleeding in 13 patients; in 1, x-ray examination was suggestive of *placenta praevia*; in 1 the attending physician considered this diagnosis because of a persisting high transverse fetal position. The

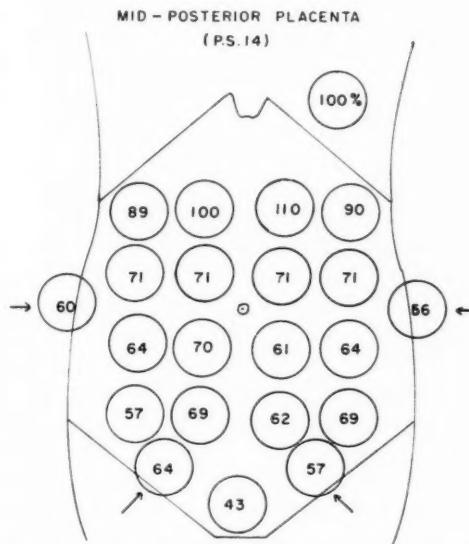


Fig. 6. Uniformly low values obtained in a mid-posterior localization, permitting diagnosis by exclusion.

isotopic findings and the final diagnoses in these patients are summarized in Table III. The 2 patients in whom the isotope

TABLE III: CORRELATION OF ISOTOPIC AND CLINICAL FINDINGS

Isotopic Findings Exclude Placenta Praevia	
Not praevia at caesarean section.....	2
Not praevia at intra-uterine palpation after vaginal delivery.....	5
Placental location not confirmed but patient delivered vaginally.....	6
	13
Isotopic Findings Indicate Possible Praevia	
Partial praevia at caesarean section.....	1
Partial praevia at intra-uterine palpation after vaginal delivery.....	1
	2
<b>TOTAL</b>	<b>15</b>

determinations indicated a possible *placenta praevia* have been discussed above. In these cases a partial *placenta praevia* was actually present but there was some inconsistency between the isotopic and the anatomical localizations. In 13 patients the isotopic findings appeared to exclude *placenta praevia*. In 2 of these, at cesarean section undertaken for other reasons, a *placenta praevia* was not found; in 5 the actual location of the placenta was determined by intra-uterine palpation after vaginal delivery, and the isotopic findings

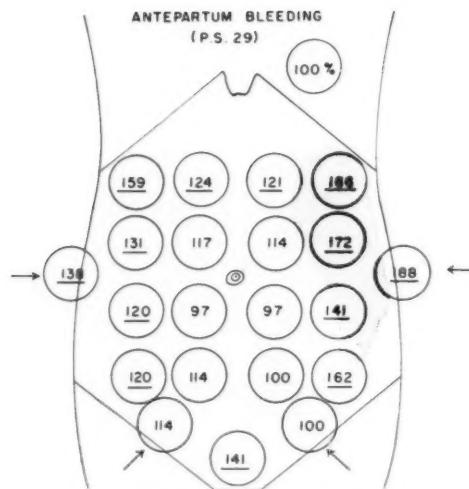


Fig. 7. Isolated elevation to 141 per cent in the suprapubic region of a patient with vaginal bleeding. This reading is inconsistent. (See text)

were confirmed; in the remaining 6 patients the location of the placenta was not determined clinically, but all had an uneventful vaginal delivery and no clinically significant degree of *placenta praevia* was present.

One patient in this group of especial interest (Fig. 7) was a severely diabetic woman admitted to the hospital at twenty-four weeks because of rather profuse vaginal bleeding. She was hospitalized for the remainder of the pregnancy. At thirty-one weeks the membranes ruptured spontaneously and vaginal bleeding occurred. The isotope study was carried out the following day, at which time there was continued slight vaginal bleeding. At cesarean section the placenta was found to cover the posterior surface of the uterus. On the left lateral aspect it extended laterally and anteriorly; it also extended rather low posteriorly, into the region in which the low transverse incision was made.

Canoy (5) reported an apparently similar case in which he was able to distinguish *placenta praevia* from *abruptio placentae*. The placenta was localized in the fundal region but high values were also obtained in the lower segment. He attributed the high lower segment values to blood collection in that area.

The present authors feel that two explanations are possible for the high values obtained in the lower segment in their case. Probably Canoy's explanation is valid; namely, that, since the patient was bleeding at the time of the study, some of the isotope was escaping from the maternal circulation and collecting in the lower uterine segment to give the high value of 141 per cent above the symphysis pubis. An alternative theory is that, because of the early gestation and the rather small and high vertex, the higher values may have been obtained because of the smaller volume of maternal and fetal tissues lying between the placenta, which extended low down posteriorly, and the detector placed just above the symphysis pubis.

It may be of interest that this patient was maintained on bed rest and intramuscular progestin therapy, and delivery did not occur until four weeks after the premature rupture of the membranes, *i.e.*, at thirty-five weeks. The infant, weighing 4 lb, 12 oz. at birth, survived.

#### FETAL DEATH IN UTERO

This series includes 5 patients in whom the fetus had died *in utero*. In 2 there was no area of increased activity, an observation which could indicate either a non-functioning placenta or a functioning placenta that was lying posteriorly. In the other 3 cases, an area of increased radioactivity over the uterus was found, suggesting the position of a placenta that contained circulating maternal blood.

One of these patients is especially interesting (Fig. 8). The fetus had died *in utero* after thirty-one weeks gestation. Because the patient had had a previous traumatic uterine rupture, a previous cesarean section, and was Rh-sensitized, the obstetrician planned to terminate this pregnancy by hysterectomy. A definite fundal localization was depicted, the actual counts per minute being shown in Figure 9. Following hysterectomy it was possible to take the entire intact specimen to the detector and repeat the study. Figure 10 is a simplified diagram of the uterus with

Fig. a few of confirm centa p which t for a ntion wa J. C. on the cases o localiz gested is stro utero." of intra obtain has sh uterine In v we bel and of would necesse down placen In t has be the r actual

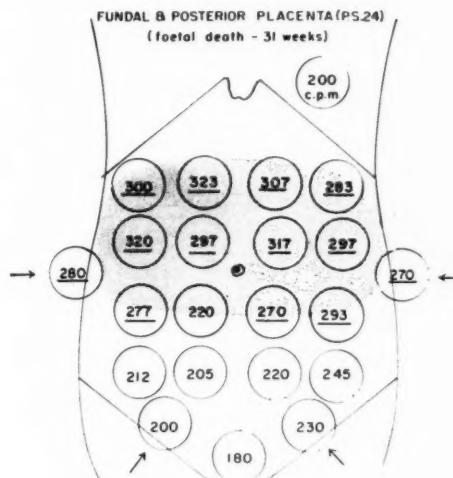
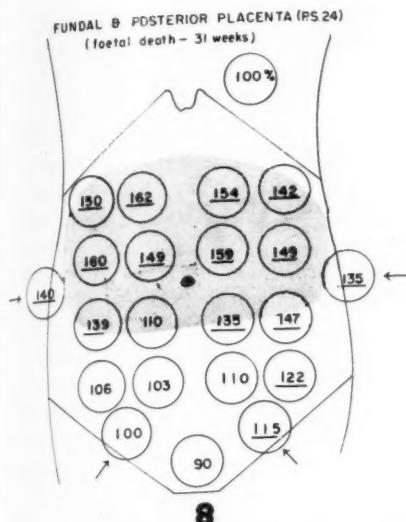


Fig. 8. Readings in a case of fetal death indicating definite placental localization.

Fig. 9. Same patient as in Fig. 8, showing actual counts per minute obtained in a case of fetal death.

a few of the actual readings. This afforded confirmation of our localization of the placenta prior to hysterectomy in a case in which the fetus undoubtedly had been dead for a number of days, as beginning maceration was evident on examination.

J. C. McClure Browne in his first report on the use of radioactive sodium cited 3 cases of intra-uterine death in which no localization could be obtained. He suggested that "failure to obtain localization is strongly suggestive of fetal death *in utero*." Weinberg *et al.* stated: "In cases of intrauterine fetal death no localization is obtained because the placental circulation has shut down—a useful test for intrauterine death emerges as a by-product."

In view of our experience just described, we believe that the suggestions of Browne and of Weinberg should be qualified. It would appear that fetal death does not necessarily mean the immediate shutting down of the maternal circulation in the placenta.

#### DISCUSSION

In the patients in whom confirmation has been obtained, the correlation between the radioisotopic observations and the actual placental location has been en-

INTACT UTERUS AND FOETUS (PS. 24)  
(fetal death — 31 weeks)

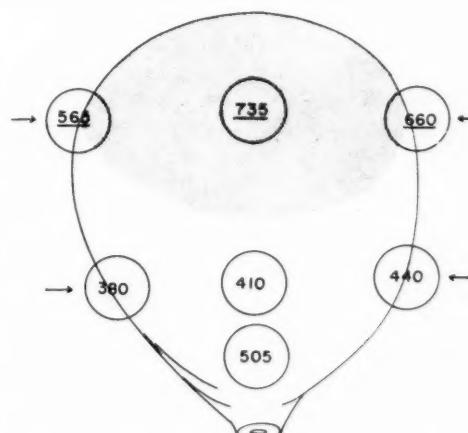


Fig. 10. Same case as in Figs. 8 and 9. Intact uterus, containing fetus, placed beneath detector following surgical removal. Pattern of elevated counts corresponded to that obtained under pre-operative conditions (Fig. 9). Dissection of specimen confirmed placental location in shaded area.

couraging. When the placenta is anterior, lateral, or in the fundal area, one can find a pattern of increased radioactivity over the placental site. If the placenta is located posteriorly, there may be an in-

crease in the counts over the posterior lateral positions, or all the areas may be low in activity, in which event the diagnosis must be made by exclusion. None of the patients in this series had a complete placenta praevia and the distribution in this condition has therefore not been observed. Experience suggests that, with the equipment employed, a placenta praevia would give low counts over most of the uterus, with an increase in activity confined to the very lowest counting areas, namely, just superior to the pubic symphysis and inguinal ligaments. With a placenta praevia that is largely posterior, there would perhaps be no area of increased activity in any of the positions that we have been scanning. The particular pattern of distribution of the radioactivity has determined our opinion about the location of the placenta. Hutchinson and his associates, who used fewer counting positions, thought they could define arbitrary levels of activity in the lower abdominal segments to establish or eliminate the presence of the placenta in that area (6). Several of the cases reported here had significantly high counts in some of the lower counting positions, but these were associated with a pattern of high counts lying superiorly and thus did not suggest a diagnosis of placenta praevia. From our experience we believe that the pattern of results obtained is a more reliable guide to placental location than any specific level noted in a particular area.

Finally, some comments about radiation dosage and the safety of the method are in order. The major considerations are the total-body radiation received by the mother; the total-body radiation received by the fetus; the radiation received by the maternal thyroid gland, and the radiation received by the fetal thyroid. Radio-iodinated human serum albumin is used because it is retained for some time within the maternal circulatory system. Even after it has left the maternal vascular system it should not cross the placenta readily. We have made no measurements comparing maternal and cord blood, but

two studies in which this was done have come to our attention. Sordo Noriega and Maass (8) found that the activity in the cord blood was less than 1 per cent of that present in the maternal blood. Hibbard and Herbert (10), who intentionally omitted Lugol's solution, found the cord plasma  $I^{131}$  concentration between 1.4 and 2.6 per cent of the maternal plasma concentration. It would appear that, as predicted, little of the radioactivity circulates in the fetus and the main source of fetal total-body radiation would be gamma radiation from the radioactive iodine distributed throughout the maternal circulation.

In calculating total-body radiation we have assumed that the radioactive albumin is distributed uniformly throughout the mother's body. We have assumed also that the total radioactive decay is in the body, *i.e.*, we neglect biological half-life and make the effective half-life equal to the physical half-life of the isotope. This will give a maximum value for radiation dosage and certainly one less favorable than the actual situation. The calculations have been made from the formulas given by Quimby, Feitelberg, and Silver (11).

For a mother weighing 132 lb. (60 kg.) who is 5 ft. 5 in. (165 cm.) tall (geometrical factor = 121) the total maternal radiation will be less than 10 millirads. Of this amount, 5.5 millirads will be from beta radiation and 3.7 from gamma radiation, for a total of 9.2 millirads. It is noteworthy that about 40 per cent of the total radiation comes from the gamma component, in sharp distinction from the situation in the thyroid when inorganic  $I^{131}$  is used. The inorganic  $I^{131}$  retained in the body following its administration for thyroid diagnosis or treatment is concentrated almost wholly in the small volume of the thyroid gland, with the result that only a small percentage of the gamma energy is absorbed in the tissue that retains the isotope. Indeed, only about 10 per cent of the total thyroid dose comes from gamma irradiation. But with radioactive iodine distributed uniformly

throughout the body, the gamma energy is absorbed by the entire body.

For the fetus, the dose will be dependent on the amount of radioactive iodine retained in the thyroid.

The

thyroid is concerned with the amount of radioactive iodine retained in the thyroid.

The

inorganic  $I^{131}$  can be retained in the thyroid.

One can

freely

in the fetus.

solution

uptake

prevents

Hibbard

block the

and the

received

curie of

can be

tion.

In c

$I^{131}$  h

reason

centa

This w

for clini

dosage

and th

1.

place

active

bumi

2.

mean

of the

tas in

by e

exten

ever,

cult.

throughout the body, as with albumin, geometrical factors greatly increase the absorption of the gamma component.

For the fetus the total-body radiation will be derived almost entirely from gamma rays emanating from the mother and will therefore be less than 4 millirads.

The radiation to the maternal or fetal thyroid will be increased if  $I^{131}$  specifically is concentrated in these organs. Inorganic  $I^{131}$  can come from two sources: small amounts of it may contaminate the radioactive albumin that is injected; metabolic degradation of the injected albumin certainly will result in the liberation of inorganic  $I^{131}$  into the maternal blood stream. One can assume that inorganic  $I^{131}$  will freely cross the placenta and reach the fetus. Administration of Lugol's iodine solution, however, can completely block uptake of  $I^{131}$  by the thyroid and thereby prevent specific irradiation of the gland. Hibbard and Herbert made no attempt to block the maternal or fetal thyroid gland and they found that the fetal thyroid received approximately 1 rad per microcurie of  $I^{131}$  albumin used. To repeat, this can be prevented by use of Lugol's solution.

In conclusion, by using 3 microcuries of  $I^{131}$  human serum albumin one has a reasonable prospect of localizing the placenta in cases of third trimester bleeding. This would seem to be a suitable method for clinical use, as the maternal radiation dosage is of the order of only 10 millirads and the fetal dosage is even less.

#### SUMMARY

1. Experience in evaluating a method of placental localization by means of radioactive iodinated ( $I^{131}$ ) human serum albumin has been presented.

2. Localization of the placenta by this means, in anterior, lateral, or fundal areas of the uterus, has been excellent. Placentas implanted posteriorly have been located by exclusion. When the placental site extends into the lower uterine area, however, interpretation of the results is difficult.

3. In its present state of development, the method may be useful as a means of excluding placenta praevia in cases in which the placenta can be located positively in areas remote from the cervix.

4. The procedure may be useful also in locating anterior and fundal implantation sites for research purposes.

5. The radiation dosage is low. While other workers have employed 5 microcuries of  $I^{131}$ , we have demonstrated that 3 microcuries can produce satisfactory results. With this amount the mother received about 10 millirads and the fetus less than 4 millirads.

5. Evidence has been presented that, in some instances of fetal death *in utero*, the maternal placental circulation continues after death and permits placental localization. This observation has relevance to the theory of afibrinogenemia production in cases of retained dead infants.

NOTE: The authors wish to record their thanks to the members of the Obstetric and Gynaecologic Staff of Victoria Hospital, London, in general, and to Prof. R. A. Kinch, in particular, who have shown their interest by referring for these studies patients both from their clinic and their private practice.

346 South Street  
London, Ont., Canada

#### REFERENCES

1. BROWNE, J. C. M., AND VEALL, N.: A Method of Locating the Placenta in the Intact Human Uterus by Means of Radioactive Sodium. *J. Obst. & Gynaec. Brit. Emp.* **57**: 566-568, August 1950.
2. BROWNE, J. C. M.: Localization of the Placenta by Means of Radioactive Sodium. *Proc. Roy. Soc. Med.* **44**: 715-718, August 1951.
3. WEINBERG, A., RIZZI, J., McMANUS, R., AND RIVERA, J.: Localization of the Placental Site by Radioactive Isotopes. *Obst. & Gynec.* **9**: 692-695, June 1957.
4. WEINBERG, A., RIZZI, J., McMANUS, R., AND RIVERA, J.: Localization of the Placental Site by a Radioactive Sodium Isotope ( $Na^{24}$ ). *Preliminary Report. Obst. & Gynec.* **8**: 396-398, October 1956.
5. CANOV, N. R.: Localization of the Placenta in Suspected Cases of Placenta Praevia with the Use of Radioactive Isotopes (RIHSA). *J. Philippine M. A.* **34**: 302-310, May 1958.
6. HUTCHINSON, D. L., BENNETT, L. R., AND GEAN, D. E. A.: Isotopic Localization of the Placenta in Placenta Praevia. *Surg., Gynec. & Obst.* **107**: 370-374, September 1958.
7. DE REZENDE, J., NAHUM, J. C., AND PENNA-FRANCA, E.: Usage des radioisotopes pour la localisation de l'insertion placentaire. *Gynéc. et obst.* **58**: 428-440, August-September 1959.

8. SORDO NORIEGA, A., AND MAASS, R.: El uso de la albumina marcada con yodo 131 para la localización de la inserción placentaria. *Gac. méd. de México* **89**: 695-710, August 1959.

9. McGEE, J., AND DURON, D.: Placentography Using Radioactive Iodinated Serum Albumin. *Obst. & Gynec.* **15**: 643-645, May 1960.

10. HIBBARD, B. M., AND HERBERT, R. J. T.: Fetal Radiation Dose Following Administration of Radio-iodinated Albumin. *Clin. Sc.* **19**: 337-344, May 1960.

11. QUIMBY, E. H., FEITELBERG, S., AND SILVER, S.: *Radioactive Isotopes in Clinical Practice*. Philadelphia, Lea & Febiger, 1958.

#### DISCUSSION

**Rosalyn S. Yalow, Ph.D.**: (Bronx, N. Y.): Was a comparison made between the dosage incident to placentography and the isotope method?

**Dr. Heagy**: I particularly avoided mention of this point and, as I am in the presence of radiologists, I hesitate to comment on radiological doses. I gather, however, that with placentography they run up to 100 to 1,000 millirads, from which it would appear that the isotope method involves a much lower exposure.

**Hymer L. Friedell, M.D.** (Cleveland, Ohio): I would like to take the prerogative of the Chairman to discuss this paper for ten seconds. There is some radiation reaching both the mother and the child

and, if one makes the assumption—which may conceivably be correct—that there is no level of radiation which does not produce some biological effect, one would then have to make some decision as to what patients are worthy of this particular test.

There ought to be some discrimination. I think that the tests ought not to be used routinely on all patients. Selection of the patients should be limited to those in whom the localization of the placenta is critical. In this way you meet the particular requirements that you are balancing the possible hazard against the possible benefit. If the benefits look great and the hazards small, that is the time to use the test.

#### SUMMARIO IN INTERLINGUA

**Le Localisation del Placenta con Albumina de Sero Human a Marcation con Iodo Radioactive**

Quaranta-duo patientes esseva examinee con le objectivo de localizar le placenta, con le uso de injectiones intra-venose de human albumina seral a marcation con iodo racioactive. Le confirmation del resultatos esseva effectuate per visualisation e/o palpation in sectiones cesaree o per immediate palpation intra-uterin post parturition vaginal.

Le localisation del placenta in le areas anterior, lateral, o fundal del utero esseva excellente. Placentas implantate posteriormente poteva esser locate per exclusion. Quando le sito placentar se extende ad in le area infero-uterin, del altere latere, le interpretation del resultatos es difficile.

In su presente stato de developpamento, le methodo pote esser de adjuta in excluder placenta previe in casos in que la

placenta es positivamente locabile in areas distante ab le cervice e in locar sitos de implantation anterior e fundal pro objectivos de recerca.

Le dose de radiation es basse. Durante que altere investigatores ha empleate 5 microcuries de  $I^{131}$ , le presente autores ha demonstrate satisfacente resultatos con 3 microcuries. Con iste dosage, le matre recipieva circa 10 millirads e le feto minus que 4.

Es presentate datos a monstrar que in certe casos de morte fetal in utero, le materne circulation placental continua post le morte e rende possibile le localisation del placenta. Le observation es significative con respecto al theoria del production de afibronogenemia in casos de retention del feto morte.

Observer

IT HAS  
the so  
DL-serin  
of sarcom  
well esta  
(1 to 2 c  
that they  
(while th  
ill effects  
low toxic  
out in co  
peutic ap  
and inju  
levels w  
neoplast  
was con  
out pre  
human  
disease.

Early  
observa  
enhanc  
was use  
tumor  
phosph  
port wi  
bination  
and in

The  
the so  
serine  
detail  
the str  
the str  
and  
acetyl  
sential  
(3).  
protein  
that  
chemi

<sup>1</sup> Pre  
Depart  
publica

<sup>2</sup> Dep

<sup>3</sup> The

<sup>4</sup> Dep

## Observations on the Antitumor Effect of N-Dichloroacetyl-DL-Serine (FT-9045)<sup>1</sup>

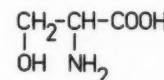
H. BLONDAL, M.D.,<sup>2</sup> I. LEVI, Ph.D.,<sup>3</sup> J. P. A. LATOUR, M.D.,<sup>4</sup> and W. D. FRASER, M.D.<sup>4</sup>

IT HAS BEEN reported recently (1) that the sodium salt of N-dichloroacetyl-DL-serine (FT-9045) inhibited the growth of sarcoma-37 in mice. The tumors were well established and of considerable size (1 to 2 c.c. in volume). The observation that they were sensitive to the compound (while the host animals suffered no obvious ill effects) is of considerable interest. The low toxicity of FT-9045 in animals stands out in contrast to most other chemotherapeutic agents, which depress hematopoiesis and injure other body systems at dose levels which are often ineffective against neoplastic growth. In view of this, it was considered reasonably safe to carry out preliminary studies with FT-9045 on human beings with far-advanced malignant disease.

Early in these trials, through a chance observation, it was suspected that an enhanced effect occurred when FT-9045 was used in combination with other antitumor agents. These agents were cyclophosphamide and x-irradiation. This report will include the results of such combinations on experimental animal tumors and in man.

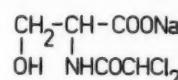
The synthesis and chemical properties of the sodium salt of N-dichloroacetyl-DL-serine (FT-9045) have been described in detail by Levi *et al.* (2). Figure 1 shows the structure of FT-9045 compared with the structures of the amino acid, serine, and chloramphenicol. The N-dichloroacetyl radical of chloramphenicol is essential for maximum antibiotic activity (3). Since chloramphenicol interferes with protein synthesis (4), it seemed logical that antimetabolites useful in cancer chemotherapy might result by modifying

### SERINE



### N-DICHLOROACETYL-DL-SERINE (Na salt)

(FT-9045)



### CHLORAMPHENICOL

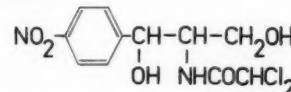


Fig. 1. The structural relationship between FT-9045 and chloramphenicol.

the structure of amino acids with this radical. Serine was modified in this manner and found to be active against experimental animal tumors.

### PHARMACOLOGICAL PROPERTIES

FT-9045 is a white crystalline compound soluble to the extent of about 15 per cent in water at room temperature. In acute toxicity studies in mice it was previously reported (1) that the LD 50 was in excess of 4 grams per kilogram of body weight. It has now been demonstrated that the LD 50 lies somewhere between 15 and 20 grams per kilogram of body weight. Infusion of a cat with 7 grams per kilogram of body weight over a period of four and a half hours produced no change in heart rate, respiration, or blood pressure, and necropsy revealed no gross pathological changes. In rats and mice treated with 1 gram per kilogram of body weight, daily, for two weeks, there were no changes in the red blood cells, hemoglobin, white cells, or

<sup>1</sup> Prepared in association with the Research Laboratories, Charles E. Frosst & Co., Montreal, Canada, and the Departments of Obstetrics and Gynaecology, and of Radiology, Royal Victoria Hospital, Montreal. Accepted for publication in December 1960.

<sup>2</sup> Department of Radiology, Royal Victoria Hospital, and the Research Laboratories, Charles E. Frosst & Co.

<sup>3</sup> The Research Laboratories, Charles E. Frosst & Co.

<sup>4</sup> Department of Obstetrics and Gynaecology, Royal Victoria Hospital.

platelets. A group of rats treated daily for five days per week, at a dose of 2 grams per kilogram of body weight, showed a slight weight loss (10 per cent) at the end of a three-month period.

FT-9045 in the antitumor dose used most frequently throughout this study (1 gram per kilogram of body weight) exerts a diuretic effect (Fig. 2). Groups

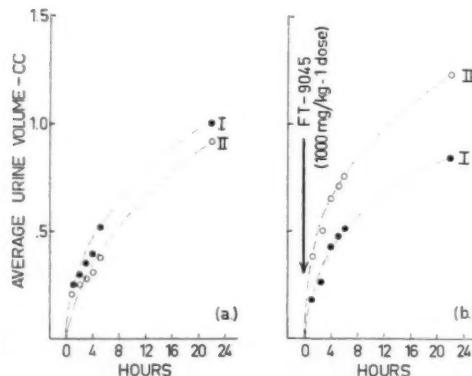


Fig. 2. Diuretic effect of FT-9045. Graph (a) shows the normal daily urinary excretion pattern of two groups (containing 6 animals each) of untreated mice. Graph (b) shows the effect of treating Group II with 1,000 mg. of FT-9045 intraperitoneally.

containing 6 mice each (Connaught) were caged individually in small metabolic cages and urine volumes were collected and estimated in small graduated flasks. Figure 2(a) shows the observations on two groups, neither of which had been treated. Figure 2(b) shows the same two groups twenty-four hours later. Group II, meantime, had received one intraperitoneal injection of FT-9045 (1 gram per kilogram of body weight). It can be seen that at the end of twenty-two hours the urinary excretion for this group averaged 1.25 c.c. compared to 0.85 c.c. for the control group. It should also be noted that most of the diuresis took place during the first six hours.

#### EFFECT OF FT-9045 ON EXPERIMENTAL ANIMAL TUMORS

**Materials and Methods:** White male mice, weighing 25 to 30 grams, from the Connaught Laboratories, Toronto, were used as hosts for sarcoma-37. Wistar

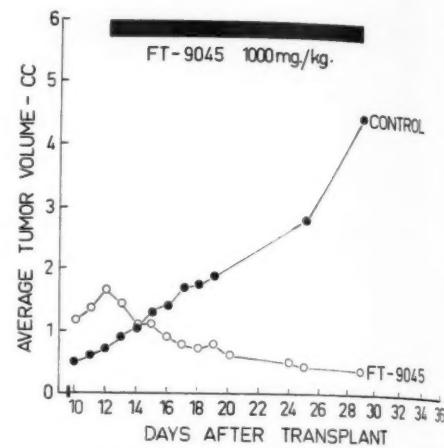


Fig. 3. Effect of FT-9045 on the growth of sarcoma-37. Each group contained 10 animals.

rats, obtained from Woodlyn Farms Ltd., Guelph, weighing 100 to 150 grams, were used as hosts for the Walker-256 carcinoma. The animals were caged in small groups of 5 or 6 and fed water and Purina chow cubes *ad libitum*.

The tumors were transplanted under conditions of "clean" technic, care being taken to avoid contamination. Fresh tumor slices, free from necrotic areas, were macerated with scalpel and scissors in sterile Petri dishes. When tumor fragments were small enough to pass a No. 18 hypodermic needle, they were transplanted subcutaneously, midway between the head and the root of the tail, on the back. It will be noted that the sarcoma-37 was grown in the solid form in the animals. The Walker-256 tumors were allowed to grow to about 15 c.c. in volume, and the sarcoma-37 to about 1.0 to 1.5 c.c., before testing was begun. The volumes were estimated by caliper measurement, the product of the length, width, and thickness being considered the tumor volume.

FT-9045 was dissolved in sterile water and, in most experiments, injected intraperitoneally. In one experiment, the solution was administered orally *via* a blunted hypodermic needle. The animals were treated and the tumors were measured daily except over occasional week-ends.

1. C
2. C
3. T
4. T
5. T
6. T
1. C
2. T
3. T
4. Meas

Cycle  
tumor  
FT-9045  
and i  
sarcom  
mg. p  
Wistar  
weight

The  
with  
combi  
group  
animal  
tainer  
maton  
with  
was a  
unit,  
ma;  
from  
tumo  
at the

*Ef*  
I sh  
survi  
were

<sup>1</sup> Ki  
Horne  
phami

TABLE I: EFFECT OF FT-9045 ON SARCOMA-37

	Treatment	No. of Animals	Dose, mg./kg.	No. of Complete Regressions	Per Cent Regression
1. Control	Untreated	40	...	2 (spontaneous)	5
2. Control	DL-serine	10	1,000	0	0
3. Test	FT-9045 (i.p.)	10	400	0	0
4. Test	FT-9045 (i.p.)	24	750	8	33
5. Test	FT-9045 (i.p.)	19	1,000	12	63
6. Test	FT-9045 (oral)	9	1,000	5	55

TABLE II: EFFECT OF FT-9045 ON WALKER-256 CARCINOSARCOMA

	Treatment	No. of Animals	Dose, mg./kg.	No. of Complete Regressions	Tumor Volume, c.c.* Treated/Control
1. Control	Untreated	31	0	0	
2. Test	FT-9045 (i.p.)	13	750	1	
3. Test	FT-9045 (i.p.)	20	1,000	1	39.5/50.6

\* Measured on 9th treatment day.

Cyclophosphamide<sup>5</sup> was one of the antitumor agents used in combination with FT-9045. It was dissolved in sterile water and injected intraperitoneally. In the sarcoma-37-bearing mice, the dose was 150 mg. per kilogram of body weight. In the Wistar rats, 75 mg. per kilogram of body weight was administered.

The second agent used in combination with FT-9045 was x-irradiation. This combination was studied only in the group bearing Walker-256 tumors. The animals were restrained in plastic containers and, with the aid of suitable collimators, the tumors were irradiated locally with one dose of 1,000 r. The radiation was administered by a Picker x-ray therapy unit, and the factors were: 280 kvp; 20 ma; h.v.l. 1.3 mm. Cu. The distance from the target of the x-ray tube to the tumor was 50 cm., and the dose rate in air at that distance was 100 r/min.

*Effect of FT-9045 on Sarcoma-37:* Table I shows the effects of FT-9045 on the survival of mice bearing sarcoma-37. There were 2 spontaneous regressions in the 40

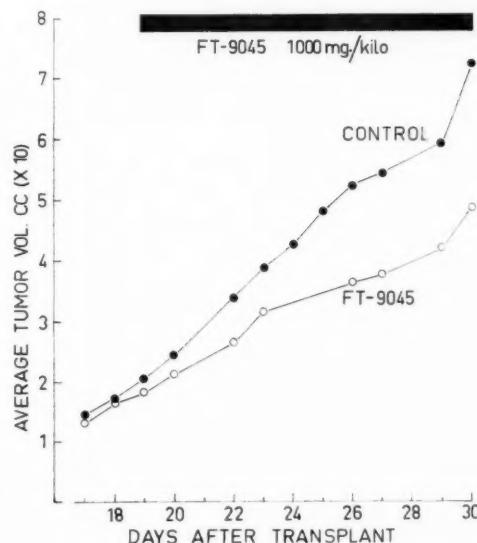


Fig. 4. Effect of FT-9045 on the growth of Walker-256 carcinosarcoma. Each group contained 20 animals.

animals making up the untreated control Group 1. The unaltered amino acid, serine, showed no antitumor effect in Group 2. Animals treated with doses of 750 mg. and 1,000 mg. of FT-9045 per kilogram of body weight, Groups 4 and 5, showed 33 and 66 per cent regressions,

<sup>5</sup> Kindly supplied through the courtesy of Frank W. Horner Ltd., Montreal (Procytox, brand of cyclophosphamide).

respectively. The animals in Group 3, receiving 400 mg. per kilogram of body weight, showed no regressions. FT-9045 administered orally was also effective (Group 6), with 55 per cent of the tumors completely regressing.

Figure 3 shows the effect of 1,000 mg. of FT-9045 per kilogram of body weight on the growth of sarcoma-37. Each group contained 10 animals. There was an immediate response of the tumors to the

volume, measured on the ninth treatment day, was 39.5/50.6, indicating a degree of tumor inhibition.

Figure 4 shows the daily growth curve of this group. Compared with sarcoma-37, the antitumor effect of FT-9045 was much less marked. There was a temporary depression in the growth rate of the treated group. After the ninth treatment day, the growth rate of the treated tumors approached that of the controls.

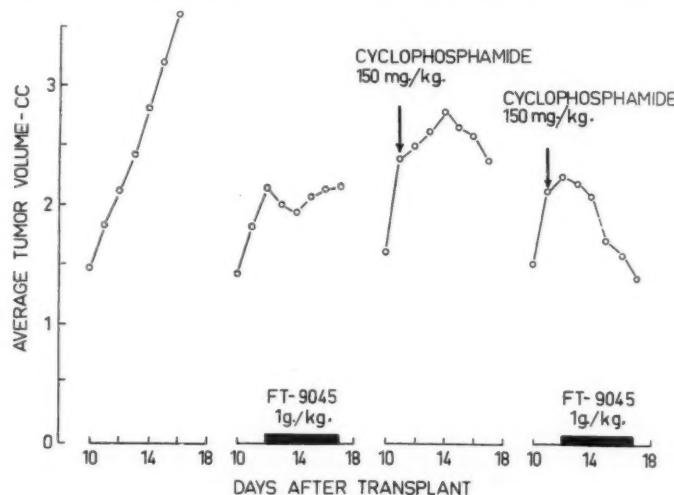


Fig. 5. Effect of FT-9045, cyclophosphamide, and a combination of FT-9045 and cyclophosphamide on the growth of sarcoma-37. Each group contained 10 animals.

compound. Measurements on the third treatment day showed them to have lost approximately a third of their volume. As they decreased in size, these tumors became very hard, and those that completely regressed, sloughed off, leaving an ulcer which eventually healed.

*Effect of FT-9045 on Walker-256 Tumors:* Table II shows the effect of FT-9045 on the survival of Wistar rats bearing the Walker-256 tumor. There were no spontaneous regressions in the 31 control animals making up Group 1. In the animals in Groups 2 and 3, receiving 750 mg. and 1,000 mg. per kilogram of body weight, respectively, there was only 1 regression in each group. In Group 3, which received 1,000 mg. per kilogram of body weight, the average treated/control tumors

*Effect of FT-9045 and Cyclophosphamide on Sarcoma-37:* Figure 5 compares the effect of FT-9045 and cyclophosphamide, given separately and in combination, on animals with sarcoma-37. There were 10 animals in each group. On the sixth treatment day the average tumor volume of the group receiving daily injections of FT-9045 was 2.12 c.c. This was approximately the same as in the group which received only one injection of cyclophosphamide (volume 2.35 c.c.). In contrast, during the same time interval, the tumors in the group receiving a single injection of FT-9045 and daily injections of cyclophosphamide had regressed to a volume of 1.40 c.c.

*Effect of FT-9045 and Cyclophosphamide on Walker-256:* The effects of this com-

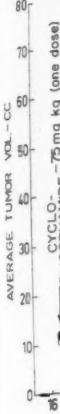


Fig. 6. Cyclophosphamide on sarcoma-37.

binatio  
Walker  
There  
the gr  
cycloph  
sole ag  
weight  
by the  
Howev  
remain  
growth  
by the  
the tu  
jection  
injec  
compl  
after  
the co  
fifth c

Effe  
Walker  
result  
of x-ir  
256 tu  
group  
to the  
tion in  
time  
the t  
the t  
x-irra

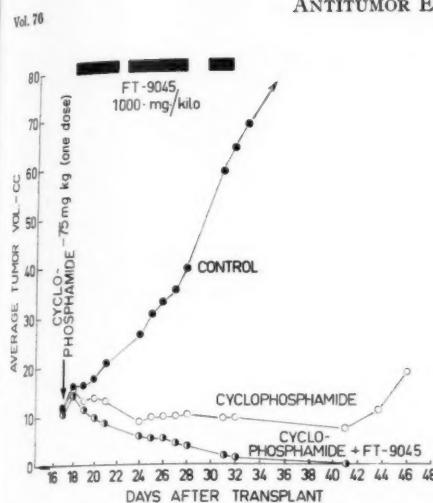


Fig. 6. Effect of a combination of FT-9045 and cyclophosphamide on the growth of Walker-256 carcinoma. Each group contained 5 animals.

bination of drugs on the growth of the Walker-256 tumor are shown in Figure 6. There were 5 animals in each group. In the group receiving one injection of cyclophosphamide intraperitoneally as the sole agent (75 mg. per kilogram of body weight), 1 tumor had regressed completely by the forty-first day after transplantation. However, by the forty-fourth day, the remaining 4 tumors had resumed their growth, and eventually killed the animals by the sixtieth day. In contrast to this, the tumors in the group given daily injections of FT-9045 as well as the single injection of cyclophosphamide had completely regressed by the forty-first day after transplant. All of the animals in the control group were dead by the forty-fifth day.

**Effect of FT-9045 and X-Irradiation on Walker-256 Tumors:** Figure 7 shows the results of x-irradiation, and a combination of x-irradiation and FT-9045 on the Walker-256 tumor. There were 8 animals in each group. One dose of 1,000 r directed locally to the tumors caused a temporary cessation in growth for four days, after which time the growth rate approached that of the control group. In contrast to this, the tumors in the animals receiving both x-irradiation and FT-9045 decreased in

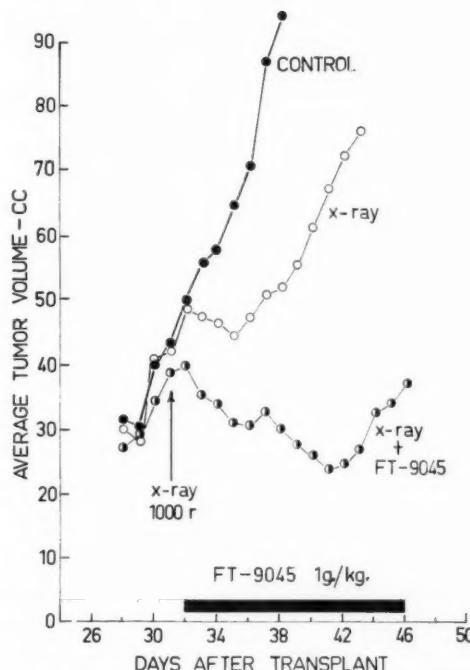


Fig. 7. Effect of a combination of FT-9045 and x-irradiation on the growth of Walker-256 carcinosarcoma. Each group contained 8 animals.

size for twelve days. On the thirteenth day, however, they began to grow again, their growth rate approaching that of the controls.

#### CLINICAL STUDIES

**FT-9045:** The first 4 patients studied were treated with FT-9045 alone. All had extremely far-advanced disease. The FT-9045 was administered intravenously as a 5 per cent solution in 1,000 c.c. of normal saline. The infusion was maintained at a slow rate, requiring two and a half to three hours for completion. During the infusion, these patients experienced a brisk diuresis which ceased two or three hours after the infusion was completed. They also experienced moderate to severe thirst during this time. Blood pressure measurements showed a slight drop (150/75 to 125/65) during the infusion and a return to normal levels when the treatment was finished. Serum electrolytes, liver function tests, and hemograms showed no

TABLE III: CASES TREATED WITH FT-9045

Case No.	Age	Diagnosis	Pathology	Extent of Disease	Previous Therapy	Diuresis	Neuropathy	Results
1. F. B.	52	Carcinoma of breast	Anaplastic	Skin metastases; edema	Mastectomy; irradiation	Yes	No	Temporary regressions in skin lesions; reduction in arm edema. Death after six weeks of therapy.
2. E. C.	68	Carcinoma of cervix	Squamous-cell	Stage 4	None	Yes	No	No demonstrable changes. Death after one month of therapy.
3. J. M.	41	Carcinoma of cervix	Squamous-cell	Stage 4	Irradiation and surgery	Yes	No	No demonstrable changes. Death after one and a half months of therapy.
4. A. B.	57	Bronchogenic carcinoma	Squamous-cell	Disseminated	None	Yes	No	No demonstrable changes. Death after three weeks of therapy.

significant alterations during the course of treatment. These patients were treated two or three times weekly.

Table III lists some of the details of these cases and the results of therapy. Case 1 was the only one of the 4 in which there appeared to be some temporary changes which might be attributed to FT-9045.

CASE 1: F. B., age 53, had a cancer of the right breast diagnosed in 1945 and treated by radical mastectomy. She remained apparently well until 1956, when a carcinoma of her left breast developed, with involvement of the axillary nodes. The tumor was considered inoperable and was treated with x-irradiation. In September 1959, just prior to treatment with FT-9045, the patient presented the following picture: The entire left chest wall, anteriorly and posteriorly, was very much thickened and hard, with irregular coloring. Some areas were "weeping"; other areas were encrusted and elevated above the surrounding normal skin. The thickened area extended over the shoulder down to the midportion of the arm and involved the anterior chest wall to a point close to the umbilicus. There were also marked pitting edema and cyanosis of the left arm and forearm, including the hand and fingers.

Seven intravenous infusions of FT-9045 were given over a period of four weeks. Two days after the first treatment, measurements of the left forearm revealed a reduction of 4 cm. in its circumference, with almost complete disappearance of the edema on the dorsum of the left hand. During the first two weeks the skin lesions showed some indication of regression. The nodular indurated areas became softer and flatter. Enough of the induration had regressed so that one was able to recognize the left breast, which had been hidden by the ex-

cessive, hard, elevated, crusty tissue which was present when the patient was first examined. These lesions continued to improve slowly during the third and fourth weeks. At the end of that time the patient deteriorated and died. Necropsy revealed extension of carcinoma to the mediastinum, left lung, and thyroid, and a chronic nephritis of long-standing. Microscopic examination showed anaplastic carcinoma with fairly extensive areas of necrosis.

*FT-9045 in Combination with X-Irradiation or Cyclophosphamide:* For ease of oral administration, FT-9045 was prepared in the form of a bland, sucrose syrup. The concentration of FT-9045 in the syrup was 2 grams per ounce.

At about the time it was shown that FT-9045 was active following oral administration, the observation was made that there was possibly an enhanced effect when the compound was administered either in combination with x-irradiation or cyclophosphamide. Twenty-one patients have been treated with one or other of these combinations (Table IV). They include 13 with carcinoma of the cervix, 2 with sarcoma of the uterus, 4 with ovarian carcinoma, 1 with carcinoma of the breast, and 1 with osteogenic sarcoma of the tibia. Seven cases were treated with a combination of cyclophosphamide and FT-9045; the remainder received radiation therapy and FT-9045.

The cyclophosphamide and FT-9045 were administered on alternate days. The

dose of grams p. phamide ranging f. During a definite no incre diuresis with diu thirst. In 19 neurop another

The t varied signs treatment before cal de plicati

CASE hystere uterus. metastas on the of the 17 she taining time the conditi and cy conti March

## ANTITUMOR EFFECT OF FT-9045

951

dose of FT-9045 ranged from 5 to 12 grams per day by mouth. Cyclophosphamide was administered orally in doses ranging from 50 to 150 mg. per day.

During treatment, 9 patients exhibited a definite diuresis; in the others there was no increase in urinary excretion, or the diuresis was questionable. Those patients with diuresis also experienced considerable thirst.

In 19 of the 21 cases an unexpected neuropathy developed at one time or another during the course of therapy.

steadily, and a chest roentgenogram at this time (Fig. 9, A) showed complete obliteration of the left lung area. She was dyspneic requiring periodic oxygen therapy, and her morphine consumption during this phase of the disease averaged 2 to 3 grains daily (Fig. 8).

Combination therapy was then started. From March 9 to April 8 the patient received 150 mg. cyclophosphamide, by mouth, and 8 doses of 12 grams each of FT-9045 by mouth.

A roentgenogram taken on March 28 (Fig. 9, B) revealed some clearing of the left lung. Morphine was no longer required (Fig. 8). During this phase of treatment there was some doubt as to whether there were any neurological complications. In any

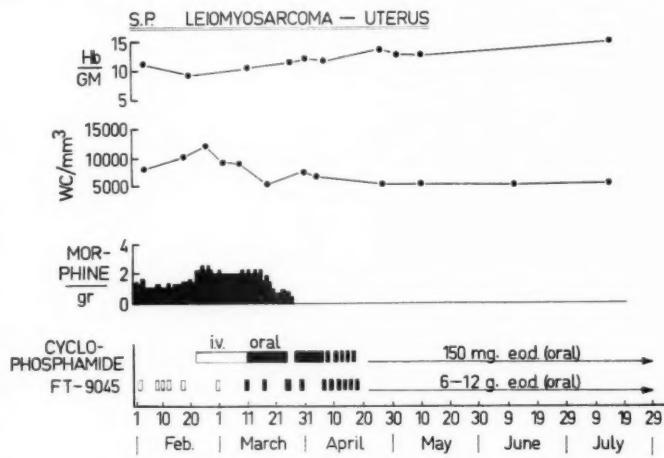


Fig. 8. Case 23. Laboratory and clinical findings, and treatment schedule during cyclophosphamide-FT-9045 combination therapy.

The time of onset of these symptoms varied. In some patients, neurological signs appeared as early as the second treatment day; in others, a month elapsed before the onset of symptoms. The clinical details of these neuropathologic complications will be discussed below.

CASE 23: S. P., age 42, underwent a subtotal hysterectomy in 1955 for leiomyosarcoma of the uterus. She presented herself in January 1960 with metastatic masses in the left lung, a pleural effusion on the same side, and destruction of large portions of the 7th and 8th ribs. Between Jan. 16 and Feb. 17 she received 13 intravenous infusions, each containing 25 grams of FT-9045. At the end of that time there was no noticeable improvement in her condition. The FT-9045 therapy was discontinued and cyclophosphamide was started on Feb. 22 and continued—100 mg. intravenously daily—until March 7. The patient's condition deteriorated

event, there were no neurological signs or symptoms when the patient was discharged from the hospital on April 14. She was sent home on the following maintenance regime: 150 mg. cyclophosphamide alternated daily with 12 grams of FT-9045. Figures 9, C and D show the subsequent changes in the chest lesions. The most recent film (Fig. 9, D) shows new bone formation in the 7th and 8th ribs. Hematological studies (Fig. 8) during treatment show a mild leukopenia ( $5,000/\text{mm}^3$ ) and a gradual rise in hemoglobin from 9.3 to 13 grams/100 c.c.

At the time of this report nine months had elapsed since the institution of combination therapy. The lesions are believed to have regressed completely, and the patient is leading a normal life, caring for her large family. She is continuing to take FT-9045 and cyclophosphamide on alternate days, and frequent follow-up examinations show no adverse effects. Hemoglobin is 13.1 grams/100 c.c., and the total white cell count is 10,500. There have been no signs or symptoms of neuropathy up to the time of this report.

TABLE IV: CASES TREATED WITH FT-9045 IN COMBINATION WITH EITHER CYCLOPHOSPHAMIDE OR IRRADIATION

Case No.	Age (years)	Diagnosis	Pathology	Extent of Disease	Previous Therapy	Present Treatment		Months Since Start of Therapy	Diure-Neuro-sis pathy	Results
						Present Treatment	Months Since Start of Therapy			
5. E. M.	39	Carcinoma of cervix	Squamous-cell	Stage 2	Radium	Cyclophosphamide + FT-9045	?	Yes	3	No evidence of tumor
6. L. R.	44	Carcinoma of cervix	Invasive squamous-cell	Stage 1	None	Irradiation + FT-9045	?	Yes	3	No evidence of tumor
7. W. J.	34	Carcinoma of cervix	Invasive squamous-cell	Stage 3	None	Irradiation + FT-9045	Yes	Yes	6	Pelvis free and mobile. No evidence of tumor
8. H. H.	30	Carcinoma of cervix	Invasive squamous-cell	Stage 1. Recurrence in pelvis	Total hysterectomy	Irradiation + FT-9045	Yes	Yes	3	Tumor no longer palpable. Leg swelling much diminished
9. M. D.	77	Carcinoma of cervix	Squamous-cell	Stage 4 (terminal)	None	Irradiation + FT-9045	?	Yes	1 1/3	No change in lesions. Death after 1 1/3 months of treatment
10. B. F.	50	Carcinoma of cervix	Squamous-cell	Stage 1	None	Irradiation + FT-9045	Yes	3	Too early to assess	
11. R. M.	51	Carcinoma of cervix	Invasive squamous-cell	Stage 1 (huge)	None	Irradiation + FT-9045	?	Yes	1 1/2	No evidence of tumor; cervix normal in size; hyperemic with necrosis in the canal
12. L. L.	38	Carcinoma of cervix	Invasive squamous-cell	Stage 4 (terminal)	None	Irradiation + FT-9045	Yes	Yes	2	No change in lesions. Death after 2 months of treatment
13. L. M.	60	Carcinoma of cervix	Squamous-cell	Stage 4 (terminal)	Radiation	Cyclophosphamide + FT-9045	Yes	Yes	3 1/2	No change in lesions. Death after 3 months of therapy
14. G. V.	48	Carcinoma of cervix	Squamous-cell	Stage 2 (terminal)	Radiation	Irradiation + FT-9045	Yes	Yes	2	No change in lesions. Death after 2 months of treatment
15. I. S.	62	Carcinoma of cervix	Invasive squamous-cell	Stage 2	None	Irradiation + FT-9045	Yes	Yes	3 1/2	Rectally, still some thickening in right parametrium (Nov. 15)
16. R. F.	54	Carcinoma of cervix	Squamous-cell	Stage 2. Pelvic recurrence	Radiation	Cyclophosphamide + FT-9045	?	Yes	2 1/2	No change in lesions. Death after 2 1/2 months of treatment
17. M. C.	53	Carcinoma of cervix	Invasive squamous-cell	Stage 3. Pelvic recurrence	Hysterectomy	Irradiation + cyclophosphamide	?	Yes	3	Tumor not palpable
18. E. P.	66	Carcinoma of ovary	Papillary cystadenocarcinoma	Abdominal metastases	Total hysterectomy	Irradiation + FT-9045	Yes	Yes	3	Decrease in size of masses and pain
19. D. C.	65	Carcinoma of ovary	Papillary cystadenocarcinoma	Abdominal metastases	Laparotomy	Irradiation + FT-9045	?	Yes	2	Mass slightly smaller
20. L. B.	72	Carcinoma of ovary	Anaplastic adenocarcinoma	Abdominal metastases (stage 4)	Laparotomy	Irradiation + FT-9045	Yes	2 1/2	Disappearance of masses. No re-accumulation of ascites	
21. M. S.	60	Carcinoma of ovary	Papillary cystadenocarcinoma	Abdominal metastases. Ascites	Laparotomy	Cyclophosphamide + FT-9045	No	?	1 1/2	No change in tumor size. No re-accumulation of ascites
22. C. L.	46	Sarcoma of uterus	Leiomyosarcoma	Recurrent in vaginal vault	Hysterectomy	Cyclophosphamide + FT-9045	?	Yes	3 1/3	Tumor 3/4 original size
23. S. P.	42	Sarcoma of uterus	Leiomyosarcoma	Metastases in lungs	Hysterectomy	Cyclophosphamide + FT-9045	?	10	Pulmonary lesions disappeared; eroded ribs show new bone formation. Patient in good health at time of report	
24. V. M.	40	Carcinoma of breast	Adenocarcinoma	Metastatic to bone	Mastectomy and liver jaundice radiation	Cyclophosphamide + FT-9045	Yes	Yes	5 1/2	Liver much smaller; jaundice no longer evident; cerebral metastases?
25. D. R.	41	Sarcoma of bone	Osteogenic sarcoma	Metastases in lungs	Amputation	Irradiation + FT-9045	Yes	Yes	2	Pulmonary lesion reduced to half original size

longer evident; cerebral metastases?  
Pulmonary lesion reduced to half  
original size.

Yes Yes  
2 2

Irradiation +  
FT-9045

Amputation

Metastases in  
lungs

Osteogenic sarcoma

Metastases in  
lungs

None

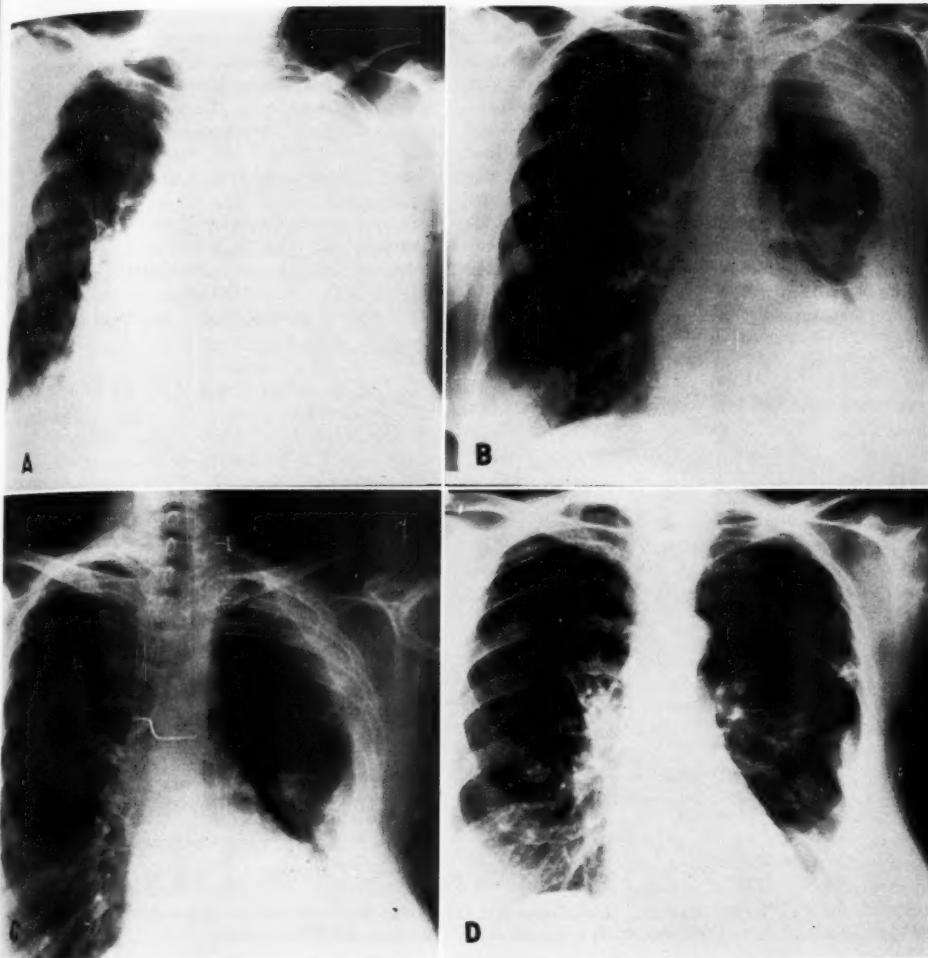


Fig. 9. Case 23. A. March 7, 1960, after three weeks of intravenous cyclophosphamide therapy. B. March 28, 1960, two and a half weeks after initiation of combined cyclophosphamide-FT-9045 therapy. C. June 10, 1960, after three months of combined therapy. The destructive process in the 7th and 8th ribs can now be seen on the left side. D. Nov. 14, 1960, after seven and a half months of combined therapy. The 7th and 8th ribs on the left side now show new bone formation.

CASE 24: V. M., age 40 years, underwent a radical mastectomy for adenocarcinoma of the right breast in August 1957. There was no node involvement at that time. In November 1959, skin secondaries appeared in the area of the operative scar. These subsided with x-ray therapy. In January 1960 the left breast became enlarged and firm. On clinical grounds it was decided that this represented secondary involvement, and the area was treated with  $^{60}\text{Co}$  gamma radiation. Again the lesions subsided, illustrating the radiosensitivity of this carcinoma.

On June 23, the patient was admitted to the hos-

pital with extensive bone metastases and a hard, irregular liver, enlarged to the level of the umbilicus. There was a moderate degree of jaundice, and moderate abdominal ascites was present. On June 25, a course of cyclophosphamide—50 mg. orally, twice daily—was begun. By July 6, jaundice had increased in intensity. The direct serum bilirubin increased from 2.3 to 3.7 mg. per cent during this period (Fig. 10). On July 6, combination therapy was instituted, cyclophosphamide, 100 mg., and FT-9045, 10 grams, being given on alternate days, both by the oral route.

By the end of July there was marked improvement

in the patient's condition. The liver had decreased in size and become softer, and the jaundice was much less marked. The cyclophosphamide caused a temporary leukopenia of 2,400 cells/mm.<sup>3</sup> In August paresthesias appeared in the fingers and toes. The patient became ataxic and exhibited occasional episodes of involuntary tremors of both extremities. FT-9045 therapy was discontinued, but the symptoms persisted. Early in September herpes zoster developed. This gradually subsided by the middle of October, at which time severe headaches occurred, as well as violent vomiting, without nausea. A course of 5 intramuscular injections (1.0 c.c.) of vitamin B complex (containing 5 mg. of pyridoxine

and pelvic examination revealed a widespread infiltrating squamous carcinoma, Stage 3. On May 25 the following treatment regime was begun: FT-9045, 12 grams (in divided doses) every other day, and x-ray therapy to the pelvis five days weekly, plus a total of two radium insertions. Between May 25 and July 7 the patient received an x-ray tumor dose of 3,300 rads, and  $2 \times 3,000$  mg. hours of radium.

A neuropathy developed on June 5, after ten treatment days with FT-9045. The patient became very ataxic and complained of numbness and tingling in the fingers and toes. She also had periods of confusion at that time. FT-9045 therapy was

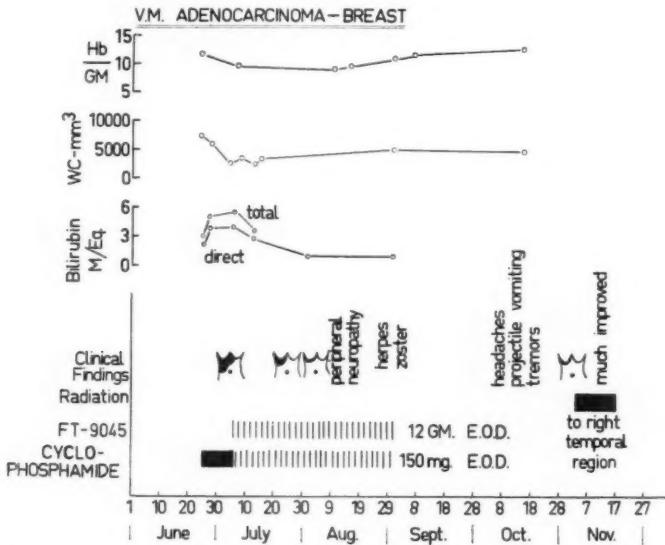


Fig. 10. Case 24. Laboratory and clinical findings, and treatment schedule, during cyclophosphamide-FT-9045 combination therapy.

per cubic centimeter) with 100 micrograms of vitamin B<sub>12</sub> was given, with no effect on the neuropathy. Electroencephalographic evidence suggested that there was abnormal activity in the right temporal region. Intracranial metastatic involvement was diagnosed and the patient was treated with Co<sup>60</sup> gamma radiation. She has shown some improvement.

An interesting point in this case is that there has been no recurrence of liver involvement; the liver has remained the same size since August, and there has been no return of jaundice or ascites. It is questionable, at the time of this report, whether the headaches and vomiting were of metastatic intracranial origin.

**CASE 7:** W. J., age 34, had refused treatment when a diagnosis of invasive squamous-cell carcinoma of the cervix, Stage 1, was made in 1958. She was re-admitted to the hospital on May 20, 1960,

discontinued on June 10. Electroencephalograms obtained on July 5 were inconclusive, showing a mild diffuse disturbance in cerebral function and minimal evidence of a disturbance in the left anterotemporal region. It was suggested at that time that these abnormalities were of metastatic origin. On July 29, repeat electroencephalograms showed no evidence of abnormality. On Sept. 16, the paresthesias and ataxia were reduced in severity and the patient was less confused. Knee, ankle, and abdominal reflexes were absent. The pelvis was free and mobile. On Nov. 22, the ataxia was no longer present and there remained only slight paresthesias in the fingers and toes. There was no evidence of pelvic disease.

This patient did not receive vitamin therapy. Her neuropathological manifestations were quite severe, but reversible. Without vitamin therapy the signs and symptoms gradually disappeared over a period of four months.

Case 8: menstrual s in April 195 carcinoma an incompl X-ray ther studies were and bilater Aug. 30, 1955 edematous than the r pulled up triangular on the le regime was day, and C

On the complained apathy, an and slurre dose of 4, charged or of 6 grams

On Sept pelvic ma leg swelling grams da and tingl FT-9045 severe a tions pro 100 mg. i relief.

CASE 2 to have a Laparotomy carcinoma and Aug total tu was disc blood an lost 30 lb revealed and a sigmoid (12 gram third tre the dose second d was sym increased pelvis fe could be

On O because tremie and pla 5 intrac (contain meter) She wa

Case 8: H. H., age 30, with a history of intermenstrual spotting for three months, was examined in April 1959 and found to have a Stage 1 squamous carcinoma of the cervix. At that time she received an incomplete course of local radium (5,625 mg. hr.). X-ray therapy was withheld. In June, cytologic studies were still positive, and a total hysterectomy and bilateral salpingo-oophorectomy was done. On Aug. 30, 1960, the patient was seen with a painful, edematous left leg (1 1/2 inches larger in diameter than the right leg). The vault of the vagina was pulled up on the left side and fixed to the apex of a triangular fixed mass, measuring 3 cm., with its base on the left pelvic wall. The following treatment regime was begun: FT-9045, 12 grams every second day, and  $\text{Co}^{60}$  gamma-ray therapy.

On the third FT-9045 treatment day the patient complained of nausea, vomiting, sleepiness, and apathy, and the nurses noted some disorientation and slurred speech. She received a total tumor dose of 4,900 rads to the left pelvis and was discharged on Sept. 9 on a maintenance dose of FT-9045 of 6 grams every second day.

On Sept. 23, examination revealed absence of the pelvic mass, no leg pain, and disappearance of the leg swelling. The dose of FT-9045 was reduced to 4 grams daily because of ataxia, nausea, numbness and tingling of fingers and feet. On Nov. 15, FT-9045 was discontinued because of toxic effects (severe ataxia). Intravenous vitamin  $B_{12}$  injections produced no improvement. Vitamin  $B_6$ , 100 mg. intravenously for three days, gave dramatic relief.

CASE 20: L. B., age 72, was found in April 1960 to have a pelvic tumor, 6 to 7 inches in diameter. Laparotomy was performed, and a Stage 4 adenocarcinoma of the ovary was found. During July and August  $\text{Co}^{60}$  gamma radiation was given for a total tumor dose of 3,400 rads. On Aug. 22 it was discovered that the patient had been passing blood and pus per rectum for five weeks, and had lost 30 lb. of weight in three months. Examination revealed a large (6 inches in diameter) pelvic mass and a fistula which seemed to extend from the sigmoid to the tumor tissue. On Sept. 9, FT-9045 (12 grams every other day) was started. On the third treatment day severe diarrhea developed and the dose of FT-9045 was reduced to 6 grams every second day. On Sept. 23 the patient felt better and was symptom-free, and the FT-9045 dose was increased to 8 grams every second day. On Oct. 7 the pelvis felt more mobile and "rubbery" and no mass could be felt.

On Oct. 29, the patient was admitted to hospital because of severe ataxia, paresthesias of the extremities, headaches, and nausea. Knee, ankle, and plantar reflexes were absent. She was given 5 intramuscular injections of vitamin B complex (containing 5 mg. of pyridoxine per cubic centimeter) daily and became completely rehabilitated. She was discharged on Nov. 11 on 50 mg. of pyri-

doxine per day orally and 2 grams of FT-9045 every second day. She was re-admitted on Nov. 26, with recurrence of her neuropathy, and intravenous pyridoxine therapy produced considerable relief.

CASE 22: C. L., age 46, was seen with a vaginal vault recurrence of a leiomyosarcoma which had been treated in 1953 by total hysterectomy. Pelvic examination revealed what appeared to be a normal vulva and lower vagina. A cervix-like, friable mass about 5 cm. in diameter, was present in the vault, fixed to the side wall of the pelvis. On Aug. 23, 1960, treatment with cyclophosphamide, 150 mg. per day per mouth was instituted. On Sept. 2 the lesion had doubled in size. On Sept. 9 it was still longer and was fixed firmly to the left pelvic wall.

Beginning Sept. 16, FT-9045 (12 grams per day) and cyclophosphamide (200 mg. per day) were given on alternate days. On Oct. 14 the lesion appeared cleaner and seemed to be epithelializing. There was a tumor-free space evident between the mass and the pelvic wall. FT-9045 was increased to 16 grams every other day.

On Oct. 27, the patient was seen with dizziness, tingling in the fingers and toes, and ataxia, which had been present since the FT-9045 dosage was raised. Pyridoxine, 50 mg. by mouth daily, produced no improvement, and the dose of FT-9045 was reduced to 6 grams every second day.

On Nov. 28, the patient exhibited marked ataxia, paresthesias, and slurred speech. The vaginal lesion appeared smaller and well epithelialized, and there was no vaginal discharge. One intravenous dose of pyridoxine (250 mg.) brought about a remission in the neuropathy in twenty-four hours.

CASE 11: R. M., age 51, was first seen on Sept. 28, 1960, with a history of bloody vaginal discharge of five months duration. Pelvic examination revealed a friable "barrel-shaped" tumor 3 inches long, strictly confined to the cervix, involving the posterior and lateral lips. On Oct. 3 radiation and FT-9045 therapy was started. Eight grams of FT-9045 were given every other day, and by Nov. 4, an x-ray tumor dose of 3,322 rads had been delivered and there had been two radium insertions of 3,000 mg. hours each. On Nov. 6 the patient first complained of numbness and tingling in the fingers and toes and mild headaches. She was discharged on Nov. 9 on 4 grams of FT-9045 every second day. Examination at that time revealed a normal pelvis with no sign of tumor. On Nov. 14 she complained of dry, sand-like irritation of the eyes, numbness and tingling of the fingertips and toes, and occipital headaches. She was unable to keep her hands in warm dish water longer than ten seconds. FT-9045 therapy was discontinued. On Nov. 22, an intramuscular injection of 100 micrograms of vitamin  $B_{12}$  was given. There was no change in symptoms, however, and on Nov. 30 the patient received 150 mg. vitamin  $B_6$  intravenously, with symptomatic relief.

**CASE 5:** E. M., age 39, was first seen on Oct. 26, 1959, with a history of heavy menstruation for ten months. Pelvic examination revealed a Stage 2 squamous-cell carcinoma of the cervix involving the vault of the vagina. On Oct. 28 the patient received 3,600 mg. hr. of radium. On July 6, 1960, she underwent a laparotomy; positive nodes were found up to the renal vessels, and the bilaterally involved ovaries were removed. On July 18, 1,800 mg. hr. of radium were applied to the vaginal vault. On July 22, 3  $\times$  1 mg. radium needles were inserted around metastatic nodules infiltrating the urethra.

On Aug. 22, the patient was suffering considerable pain in the back and in both groins, and she was started on cyclophosphamide and FT-9045 therapy by mouth. She received cyclophosphamide, 150 mg. per day, and FT-9045, 12 grams on alternate days. During the course of this therapy, she experienced periods of depression, headaches, and burning, aching sensations in her feet. Examination on Sept. 6 showed that there was no growth along the vaginal wall and the cervix did not feel "active"; also pain had disappeared. The latest report, on Dec. 4, 1960, indicated that there was no evidence of tumor, and the patient had continued symptom-free.

#### DISCUSSION AND CONCLUSIONS

The animal data recorded above show that FT-9045 has an adverse effect on the growth of sarcoma-37 in mice and Walker-256 in rats, the effect being more pronounced against the former tumor. The mechanism of action is not yet known. Serine and its interconversion product, glycine, occupy an important place in normal cellular metabolism (5-9). It has also been shown that serine and glycine are interconvertible in tumor tissue, just as they are in normal tissue (10), and that tumor tissue has a far greater capacity to convert glycolytic intermediates to serine and glycine than do normal tissues (11). Evidence that there is a degree of dependence of tumor tissue on serine and/or glycine has been reported by McCoy *et al.* (12, 13), who showed that these two amino acids markedly stimulate the *in vitro* growth of the Walker-256 carcinosarcoma and the Jensen sarcoma. Further evidence for this dependence on serine was recently reported by Lockart and Eagle (14), who showed that small inocula of HeLa cells failed to grow in a synthetic

medium in the absence of serine. The significance of this amino acid leads us to theorize that the modified serine FT-9045 may act by antagonizing or blocking the action of serine, or its *in-vitro* precursors.

It is doubtful whether the diuretic effect of FT-9045, which has been described in both animals and man in this report, has any direct association with the antitumor effect of the compound. In this respect, FT-9045 is most likely acting as an osmotic diuretic. It is well known that parenteral or oral administration of large amounts of amino acids will produce a relative aminoaciduria with increased water excretion (15, 16).

The animal data on FT-9045 in combination with cyclophosphamide or irradiation clearly show an enhancement of antitumor effect. No attempt has been made at this time to study the mechanism of this enhanced action. There are reports in the literature (17, 18) of increased effects of combinations of two or more antitumor agents against animal tumors. A recent report by Foye *et al.* (19) describes the potentiation of radiation effects by 5-fluorouracil in man.

It is impossible to transfer the findings of animal experimentation to man, and it is also difficult to make the precise observations and conclusions in our series of patients that were possible in our animal work. We have, however, made an attempt to evaluate our clinical experience.

The clinical results have been divided into the following broad categories: (a) unexpectedly good results; (b) presumed positive results; (c) negative results.

##### (a) Unexpectedly Good Results:

**Case 7:** The rapid disappearance of this patient's tumor was a surprise. Although rapid dissolution of such tumors under standard radiation treatment does occur, it is believed that FT-9045 had some influence in this case.

**Case 8:** The disappearance of leg swelling and pain, together with the resolution of tumor infiltration, is a most unusual result of treatment in this clinical situation.

**Case 17:** Unexpected dissolution of the

tumor together with marked clinical improvement.

*Case 23:* This unusual case is considered the most outstanding success in this series, because of the absence of radiation therapy and the complete transformation of the patient, who had been admitted *in extremis*, to her present status. The fact that she was treated for long periods with both FT-9045 and cyclophosphamide, however, will always leave a doubt as to which of the two agents contributed most to her clinical improvement. Nevertheless, it is felt that the effect was brought about by the fortuitous combination of the two agents.

*Case 24:* This case is of special interest. The patient was hospitalized, bedridden, *in extremis*, with grossly involved liver, ascites, and jaundice. Coincidental shrinkage of the liver, disappearance of jaundice, and remission of the ascites, together with the fact that the patient is now home, free of obvious tumor, forces a conclusion that her clinical improvement was brought about by the combined therapy.

*(b) Presumed Positive Results:*

*Case 1:* In this case the observed tumor effect was obtained on FT-9045 alone. Although the patient died, it is believed that the temporary remission was real and due to FT-9045.

*Cases 6, 10, and 11:* These 3 patients with Stage 1 carcinoma of the cervix were given FT-9045 during the course of standard radiation therapy. The rapid disappearance of tumor could be explained as due to radiation therapy alone, but such a finding in 3 consecutive cases is unusual.

*Cases 5 and 15:* These 2 cases of Stage 2 carcinoma of the cervix have shown good clinical results.

*Cases 18, 19, 20, and 21:* These 4 cases of advanced ovarian carcinoma have all shown some degree of clinical improvement under combined therapy.

*Case 22:* In this case of sarcoma of the uterus there have been arrest of the bleeding from the tumor, complete re-epitheliali-

zation of the necrotic ulceration of the surface, and no further growth.

*Case 25:* Reduction in the size of the lung metastases from osteogenic sarcoma, as a result of irradiation, is rather rare. The improvement in this case is thought to be due to combined therapy.

*(c) Negative Results:* The remainder of the cases, 8 in number, failed to show any clinical improvement. But it must be mentioned that these patients were all considered terminal at the time of institution of treatment.

*Neuropathy Associated with FT-9045 Therapy*

The unexpected neuropathy which occurred in 19 of the 25 patients has been briefly mentioned. In view of the possible association of this complication with vitamin B<sub>6</sub> deficiency, signs and symptoms will be discussed in detail. Initially, some of the patients complained of depression, followed by nausea, and occasionally vomiting. The majority of the patients suffered from headaches, which were usually deep-seated, dull, and throbbing, and localized to the frontal and/or occipital areas. Shortly thereafter, paresthesias of the hands and feet occurred, with numbness, tingling, and chilliness of these parts. These manifestations began at the distal phalanges of all digits and progressed proximally in a glove-stocking distribution to the mid-forearm and knee. At a later stage, the patients exhibited gross tremors, and the inability to carry out fine movements, such as writing or knitting. Nurses have reported changes in personality, the patients often becoming irritable and demanding over petty matters.

In occasional patients, diplopia, slurred speech, and ataxia occurred. Some in the ataxic stage were unable to walk, and at this stage, knee, ankle, and plantar responses were absent. Several patients have complained of a pruritic rash over the forearms and shoulders. In one instance a generalized pruritic skin reaction developed, which was maculopapular, exfoliative, and crusting in nature. It re-

sponded well to topical therapy of a general nature. It has been observed that the neuropathologic complications are reversible and regress completely over several weeks or months when the cytotoxic agents are discontinued.

The neuropathy in this series of cases, and its rather sudden onset, resembled in many respects the peripheral neuropathy which occurs in tuberculous patients treated with isoniazide (20). The addition of vitamin B<sub>6</sub> to isoniazide therapy causes these symptoms to disappear. Dietary deficiency of pyridoxine (21, 22) produces similar symptomatology in man, alleviated by pyridoxine therapy.

Five patients in our series with rather severe neuropathies were treated with large doses of pyridoxine (150-250 mg. intravenously), with dramatic amelioration of their symptoms. In one case, where xanthurenic acid levels in the urine were measured, the values were abnormally high and seemed to substantiate the fact that the neuropathy is associated with low vitamin B<sub>6</sub> levels.

There is some evidence that pyridoxine is implicated in the neoplastic process. It has been reported that the growth of mouse sarcoma-180 (23) and mouse adenocarcinoma-755 is inhibited if these tumors are transplanted into animals on a diet deficient in pyridoxine. It is interesting to speculate on the possibility that the observed antitumor effect of FT-9045, together with the neuropathy which is relieved by intravenous pyridoxine, may implicate pyridoxine as an important factor in tumor growth in man.

The authors do not claim to have achieved cures, but it is felt that the use of FT-9045 in conjunction with cyclophosphamide or deep x-ray therapy may have some effect on human cancer. The essentially mild nature of the side-effects has encouraged us to probe further into this combined therapy.

#### SUMMARY

1. The effect of the sodium salt of N-dichloroacetyl-DL-serine (FT-9045) on

two animal tumors (sarcoma-37 and Walker-256) and a variety of human neoplasms has been studied.

2. FT-9045, when it is used as the sole therapeutic agent, greatly inhibits the growth of sarcoma-37 in mice, and inhibits to a much lesser extent the growth of Walker-256 tumor in rats.

3. FT-9045, used in combination with cyclophosphamide, shows an enhanced effect against the growth of sarcoma-37 in mice and Walker-256 tumor in rats. FT-9045 used in combination with x-irradiation shows a similar enhanced effect against the Walker-256 tumor.

4. FT-9045, used as the sole therapeutic agent in a small series of human cancer, showed a very temporary effect in one case.

5. FT-9045, used in combination with either cyclophosphamide or radiation, showed unexpectedly good results in 5 cases, presumed positive results in 11 cases, and negative results in 5 cases.

6. FT-9045 therapy appeared to cause a peripheral neuropathy in most cases. This neuropathy was of a temporary nature, gradually disappearing after cessation of therapy. Vitamin B<sub>6</sub> intravenously produced dramatic amelioration of the symptoms.

NOTE: The authors wish to express their appreciation to Dr. E. Lozinski, Medical Director, Charles E. Frosst & Co., Montreal; Dr. Carleton B. Peirce, Radiologist-in-Chief, Dept. of Radiology, Royal Victoria Hospital, and Dr. G. B. Maughan, Obstetrician and Gynaecologist-in-Chief, Royal Victoria Hospital, Montreal, for their assistance and interest in this study. The authors also acknowledge with thanks the technical assistance of Miss Joan Palmer and Mr. J. Zanelli, of Charles E. Frosst & Co., Montreal.

#### ADDENDUM

Since the acceptance of this report for publication, N-dichloroacetyl-DL-Serine has been administered in the form of a compressed tablet. This has resulted in a marked reduction in the number of patients showing signs and symptoms of neurotoxicity. In those patients (15 per cent) in our current trials who develop a neuropathy during therapy, the symptoms are mild, and seem to be limited to paresthesias of the fingers and toes. This would suggest that the stability of the original

aqueous p  
with respe  
decomposi  
largely re  
described  
/ Charles  
P. O. Box  
Montreal 3  
  
1. LE  
Serine De  
131:666,  
2. LE  
WEED, J.  
Serine, an  
Salts. C  
3. H  
Jr., HOP  
tion of  
Structure  
Antibiotic  
4. G  
Amino Ac  
London,  
Co., 1958  
5. K  
dism and  
656, July  
6. H  
Biosynth  
C<sup>14</sup>. Pur  
186: 447  
7. E  
Serine an  
Chem. 10  
8. S  
Biologica  
Chem. 1  
9. V  
Precurs  
Chem. 1  
10. D  
Serine  
ember  
11. I  
Enzyme

N-  
de sa  
dotat  
morif

Us  
illo i  
de sa  
multo  
Walk  
FT-9  
in u  
ment

37 and aqueous preparations should now be investigated with respect to the possibility of the formation of decomposition products which may have been largely responsible for the severe neurotoxicity described in this report.

Charles E. Frost & Co.  
P. O. Box 247  
Montreal 3, Quebec, Canada

## REFERENCES

- LEVI, I., BLONDAL, H., AND LOZINSKI, E.: Serine Derivative with Antitumor Activity. *Science* **131**: 666, March 4, 1960.
- LEVI, I., KOLLER, A. E., LAFLAMME, G., AND WEDD, J. W. R.: N-Dichloroacetyl Derivatives of Serine and Threonine, and of Their Esters and Sodium Salts. *Canad. J. Chemist.* **38**: 1135, 1960.
- HAHN, F. E., HAYES, J. E., WISSEMAN, C. L., JR., HOPPS, H. E., AND SMADEL, J. E.: Mode of Action of Chloramphenicol. VI: Relation Between Structure and Activity in the Chloramphenicol Series. *Antibiotics & Chemother.* **6**: 531-543, September 1956.
- GALE, E. F.: Ciba Foundation Symposium. Amino Acids and Peptides with Antimetabolic Activity. London, J. & A. Churchill; Boston, Little, Brown & Co., 1958, pp. 157-170.
- KIT, S., AND GRIFFIN, A. C.: Cellular Metabolism and Cancer: A Review. *Cancer Res.* **18**: 621-656, July 1958.
- HEINRICH, M. R., AND WILSON, D. W.: The Biosynthesis of Nucleic Acid Components Studied with  $^{31}$ P: Purines and Pyrimidines in Rat. *J. Biol. Chem.* **186**: 447-460, October 1950.
- ELWYN, D., AND SPRINSON, D. B.: The Role of Serine and Acetate in Uric Acid Formation. *J. Biol. Chem.* **184**: 465-474, June 1950.
- SIEKEVITZ, P., AND GREENBERG, D. M.: The Biological Formation of Serine from Glycine. *J. Biol. Chem.* **180**: 845-856, September 1949.
- WEINHOUSE, S., AND FRIEDMANN, B.: Study of Precursors of Formate in the Intact Rat. *J. Biol. Chem.* **197**: 733-740, August 1952.
- KIT, S.: The Biosynthesis of Free Glycine and Serine by Tumors. *Cancer Res.* **15**: 715-718, December 1955.
- KOSHLAND, D. E., JR., AND ERWIN, M. J.: Enzyme Catalysis and Enzyme Specificity Combination of Amino Acids at the Active Site of Phosphoglucomutase. *J. Am. Chem. Soc.* **79**: 2657, 1957.
- McCoy, T. A., AND NEUMAN, R. E.: The Cultivation of Walker Carcinosarcoma 256 in Vitro from Cell Suspensions. *J. Nat. Cancer Inst.* **16**: 1221-1229, April 1956.
- McCoy, T. A., MAXWELL, M., AND KRUSE, P. F., JR.: Amino Acid Requirements of the Novikoff Hepatoma in Vitro. *Proc. Soc. Exper. Biol. & Med.* **100**: 115-118, January 1959.
- LOCKART, R. Z., JR., AND EAGLE, H.: Requirements for Growth of Single Human Cells. *Science* **129**: 252-254, Jan. 30, 1959.
- GEYER, R. P.: Parenteral Nutrition. *Physiol. Rev.* **40**: 150-186, January 1960.
- CHRISTENSEN, H. N., LYNCH, E. L., AND POWERS, J. H.: The Conjugated, Non-Protein Amino Acids of Plasma: Peptidemia and Hyperpeptiduria as Result of Intravenous Administration of Partially Hydrolyzed Casein (Amigen). *J. Biol. Chem.* **166**: 649-652, December 1946.
- WOLBERG, W. H., AND CURRENI, A. R.: Potentiation of 5-Fluorouracil by Combination Chemotherapy in Animals. *Cancer Chemother. Rep.* **6**: 6-7, February 1960.
- BURCHENAL, J. H., OETTGEN, H. F., REPPERT, J. A., AND COLEY, V.: Studies on the Synergism of Fluorinated Pyrimidines and Certain Pyrimidine and Purine Derivatives Against Transplanted Mouse Leukemia. *Cancer Chemother. Rep.* **6**: 1-5, February 1960.
- FOYE, L. V., JR., WILLETT, F. M., HALL, B., AND ROTH, M.: The Potentiation of Radiation Effects with 5-Fluorouracil. *Cancer Chemother. Rep.* **6**: 12-15, February 1960.
- OESTREICHER, R., DRESSLER, S. H., AND MIDDLEBROOK, G.: Peripheral Neuritis in Tuberculous Patients Treated with Isoniazid. *Am. Rev. Tuberc.* **70**: 504-508, September 1954.
- SNYDERMAN, S. E., CARRETERO, R., AND HOLT, L. E., JR.: Pyridoxine Deficiency in the Human Being. *Fed. Proc.* **9**: 371, 1950.
- SNYDERMAN, S. E., HOLT, L. E., JR., CARRETERO, R., AND JACOBS, K. G.: Pyridoxine Deficiency in Human Infant. *J. Clin. Nutrition* **1**: 200-207, March-April 1953.
- MIHICH, E., ROSEN, F., AND NICHOL, C. A.: The Effect of Pyridoxine Deficiency on a Spectrum of Mouse and Rat Tumors. *Cancer Res.* **19**: 1244-1248, December 1959.

## SUMARIO IN INTERLINGUA

## Observationes Clinic in Re le Effecto Anti Tumores de N-Dichloroacetyl-DL-Serina

N-dichloroacetyl-DL-serina, in le forma de sal a natrium (FT-9045) se ha monstrate dotate de activitate anti tumores in tumoriferes animales experimental.

Usate como exclusive agente therapeutic, illo inhibiva marcatemente le crescentia de sarcoma-37 in muses e etiam—ben que multo minus marcatemente—de tumor Walker-256 in rattos. Le combination de FT-9045 con cyclophosphamida resultava in un effecto potentiate contra ambe le mentionate tumores. Le combination de FT-9045 con therapia a radios X augmen-

tava similemente le action contra le tumor Walker in rattos.

Viste le basse toxicitate de FT-9045 (tanto in administrationes parenteral como etiam in administrationes oral) e le absentia de un effecto de illo in le tissus hematopoietic, un studio clinic preliminari esseva effectuate in un numero de casos de cancre avantiate.

In le essayos initial, FT-9045 esseva usate como le agente exclusive e administrate per via intravenose in le forma de un solution de 5 pro cento in salina normal.

Durante le tractamento, le patientes experientiava un vive diurese accompaniante de moderate grados de sete. Esseva constatare nulle alterationes in le hemogrammas o in le valores biochimic in iste patientes. In un caso, indicationes clinic de regression del tumor esseva evidente. Tamen, iste efecto esseva de character transitori e non alterava in ulle maniera le curso del morbo.

In essayos subseguente, FT-9045 esseva administrate per via oral in combination con altere agentes, i.e. cyclophosphamida e radiation ionisante. In un micre serie de

casos tractate in iste maniera, il pareva occurrer un efecto "synergic" inter FT-9045 e le un o le altere del mentionate agentes additional. Inexpectatamente bon resultados esseva obtenite in 5 casos, resultados presumitamente positive in 10, e resultados negative in 8.

In le majoritate del patientes, FT-9045 pareva causar un neuropathia peripheric. Tamen, isto esseva de natura temporari e dispareseva gradualmente post le cessation del tractamento. Vitamina B<sub>6</sub> per via intravenose produceva un melioration spectacular in le symptomas neurologic.



The P

INTRAV  
Iried o  
in the  
for visual  
borders  
and rec  
An ere  
sometim  
mine m  
of the  
possible  
cumber  
common  
raphy,  
instance

Urine  
contras  
gravity  
of the  
of the  
Hypaq  
of 1.32  
has a sp  
(1) de  
a serie  
fifteen  
venous  
group  
mediu  
gravity  
Hence  
urogra  
varies  
opaqu  
layerin  
below  
urine

The  
poste  
the s  
than  
positi  
the l  
this p

## The Prone Position in Intravenous Urography for Study of the Upper Urinary Tract<sup>1</sup>

MILTON ELKIN, M.D.

INTRAVENOUS UROGRAPHY is usually carried out with the patient recumbent, in the face-up position. Occasionally, for visualization of anterior and posterior borders of the kidney, oblique-supine and recumbent lateral views are used. An erect anteroposterior projection is sometimes added to the routine to determine mobility of the kidneys, emptying of the renal pelvis and the ureters, and possible laxity of the pelvic floor. A recumbent postero-anterior study is not commonly included in intravenous urography, although such a view can in some instances add valuable information.

Urine containing the commonly used contrast materials is of higher specific gravity than non-opacified urine because of the relatively high specific gravity of the medium. Thus, 50 per cent Hypaque solution has a specific gravity of 1.32, and 76 per cent Renografin solution has a specific gravity of 1.42. Baumrucker (1) determined urine specific gravities in a series of patients just before and at a fifteen-minute collection after the intravenous injection of Diodrast. In this group urine containing the contrast medium showed an increase in specific gravity ranging from 0.007 to 0.042. Hence, during the course of intravenous urography the specific gravity of the urine varies, depending on its content of the opaque agent. In the absence of mixing, layering of the heavier, opacified urine below the less opacified or non-opacified urine occurs.

The upper pole of each kidney is more posteriorly placed than the lower; thus, the superior calyces, being more dependent than the inferior calyces in the supine position, will be more readily opacified by the heavier contrast-containing urine in this position; conversely, in the prone po-

sition, the lower group of calyces are more dependent and should be better opacified. Similarly, inasmuch as the ureter cephalad to the pelvic brim lies in a plane anterior to the renal pelvis because of the normal lumbar lordosis, the prone position might afford better visualization of the ureters during intravenous urography.

The layering of urine during intravenous urography has been the subject of previous reports. Fey and Truchot (3) in 1936 observed a patient with marked unilateral hydronephrosis due to an aberrant vessel, in whom the erect film demonstrated layering in the dilated calyces. In the discussion of this case, it was suggested that the layering was due to the different specific gravities of the contrast-laden urine and the non-opacified urine. Fey, however, had seen the layering persist for over an hour and he concluded that diffusion would by then have caused complete mixing had the effect been due only to a difference in specific gravity. Later in the same year Lepoutre and Monnier (7) demonstrated a similar appearance in 4 patients with hydronephrosis; by *in vitro* experiment they were able to show that the phenomenon is due to differential specific gravities and that in the absence of agitation the layering could persist for at least two hours. Inasmuch as the normal peristaltic activity of the calyces and pelvis offers enough mixing to prevent layering, they concluded that the presence of horizontal levels in the pelvis and calyces indicates stasis and atony of these structures.

Ettinger in 1943 (2) pointed out the possibilities of misinterpretation of anatomical changes in urography due to incomplete mixing of opacified and non-opacified urine and indicated that variations in the position of the patient during urography could give additional diagnostic informa-

<sup>1</sup> From the Department of Radiology, Albert Einstein College of Medicine, Yeshiva University, and the Bronx Municipal Hospital Center, Bronx, N. Y. Accepted for publication in November 1960.



Figs. 1 and 2. Case I.

Fig. 1. Twenty-five-minute supine study. Calyces are dilated. The dependent upper calyces are better visualized than the lower.

Fig. 2. Twenty-five-minute prone study. In this position the upper calyces have drained, resulting in better visualization of the lower group and of the ureteropelvic region.

tion. She also demonstrated the layering phenomenon *in vitro*. Hellmer in 1946 (5) suggested the use of prone and erect positions to provide better mixing of the urine in a dilated renal pelvis or dilated ureter. McLaughlin and Bowler in 1952

(8) and Keates in 1954 (6) obtained better delineation of the ureteropelvic area in urography by using the prone and erect positions in addition to the routine supine projections. Since the ureteropelvic area usually lies more anteriorly than the calyces, in the prone position, the urine containing contrast medium gravitates into this area. The prone view was also recommended by Rolleston and Reay in 1957 (9) for visualizing the ureteropelvic junction in hydronephrotic kidneys. Its value in filling the obstructed ureter in hydronephrosis and hydrourter was reported by Handel and Schwartz in 1958 (4).

Our usual projections in excretory urography have been the supine and the anteroposterior erect. In order to evaluate the possible benefit of the prone view, we have added it to our examinations during the past year. After the intravenous administration of the opaque medium (50 per cent Hypaque), anteroposterior recumbent views are obtained at five, fifteen, and twenty-five minutes, followed immediately by a twenty-five-minute prone exposure and, at thirty minutes, by an erect anteroposterior view. Abdominal compression is used for the five and fifteen-minute films. The purpose of this report is to demonstrate types of cases in which the prone position has been of aid in the examination of the upper urinary tract.

#### VISUALIZATION OF DIFFERENT PORTIONS OF THE CALYCEAL SYSTEM

**CASE I:** L. K., a 39-year-old woman, underwent a vaginal hysterectomy on Nov. 27, 1959; the bladder was inadvertently entered and during the repair the left ureteral meatus was partially compromised. Intravenous urography was performed seventeen days later. On the twenty-five-minute anteroposterior film (Fig. 1) the calyces of the left kidney appear dilated, with inadequate visualization of the renal pelvis and ureter. The prone twenty-five-minute film (Fig. 2) shows the dilated renal pelvis, dilated ureteropelvic junction, and dilated upper ureter. With the patient supine, the upper group of calyces, being dependent, are well opacified and the lower calyces are less well demonstrated, but in the prone position the lower calyces become dependent and are thus more fully delineated by the opacified urine.

CASE I  
several e  
lowing a  
The sup  
irregular  
not well  
could no  
at that s  
ever, the  
visualized  
the urete

STU  
As a  
position  
the ure  
on the

CASE  
days of d  
and hesit  
The pro  
supine p  
calyces  
shown, w  
the ure  
possibil  
tion, as  
The pro  
visualiza  
the upp  
the latt  
struction  
quent s  
occupy  
overridi  
ifice.

CASE  
termitt  
occasio  
five-min  
calculi,  
divertic  
but the  
or urete  
opacifie  
by the  
lated p  
elongat  
displace  
hydrone  
previou  
posteri  
right c  
opacifie  
penden

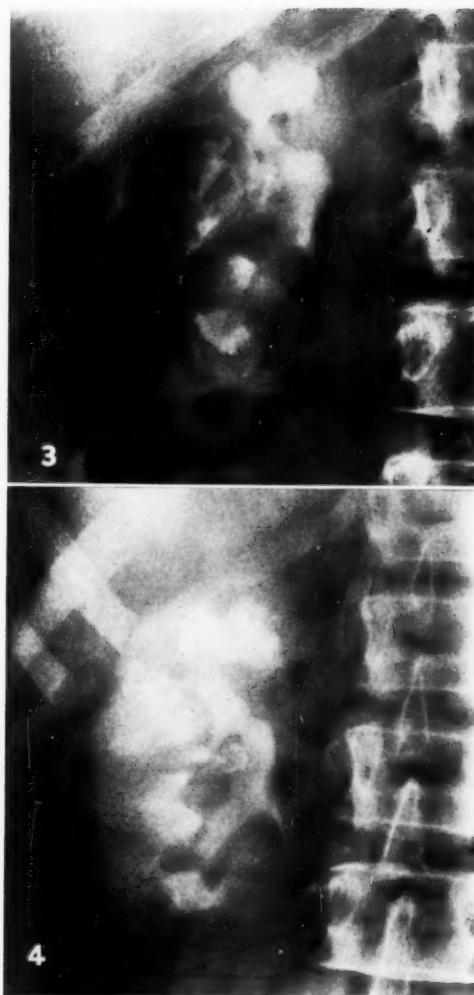
**CASE II:** E. M., a 43-year-old woman, had several episodes of pyelonephritis bilaterally following a right pyelolithotomy three years earlier. The supine twenty-five-minute study (Fig. 3) shows irregular caliectasia. The lower infundibulum is not well opacified, and study of the supine films could not exclude the possibility of a stricture at that site. On the prone view (Fig. 4), however, the dependent inferior infundibulum is well visualized and there is no evidence of stricture; the ureteropelvic junction is also better seen in this projection.

#### STUDY OF URETEROPELVIC REGION

As already reported (8, 9), the prone position will often allow visualization of the ureteropelvic region not demonstrated on the supine projection. We have had a number of such cases.

**CASE III:** F. E., a 72-year-old man, had four days of difficulty in voiding associated with dribbling and hesitancy, as well as one day of total hematuria. The prostate was moderately enlarged. On the supine projection (Fig. 5) marked dilatation of the calyces and infundibula of the left kidney was shown, with no opacification of the renal pelvis or of the ureteropelvic junction. From this view the possibility of obstruction at the ureteropelvic junction, as from an aberrant vessel, cannot be ruled out. The prone view (Fig. 6), however, shows excellent visualization of the ureteropelvic area as well as of the upper ureter. The dilatation and elongation of the latter structure indicate that the point of obstruction is below the ureteropelvic zone. Subsequent study revealed a transitional-cell carcinoma occupying the left posterior wall of the bladder, overriding and partially obstructing the left ureteral orifice.

**CASE IV:** J. L., a 67-year-old man, suffered intermittent gross hematuria for six months, as well as occasional right ureteral colic. The supine twenty-five-minute film (Fig. 7) shows multiple bladder calculi, several of which were later proved to be in diverticula. The calyces on the right are dilated but there is no visualization of the right renal pelvis or ureter. In the prone position (Fig. 8), the non-opacified urine in the pelvis and ureter are replaced by the heavier opacified urine and a markedly dilated pelvis is demonstrated, as well as a dilated and elongated ureter. The ureteropelvic junction is displaced lateralward. The hydronephrosis and hydroureter on the right were most probably due to previous right ureteral calculi. Note on the anteroposterior film the good opacification of the dependent right calyces and then on the prone view the good opacification of the anteriorly placed, now dependent, markedly hydronephrotic right renal pelvis, with loss of opacification of the calyces.



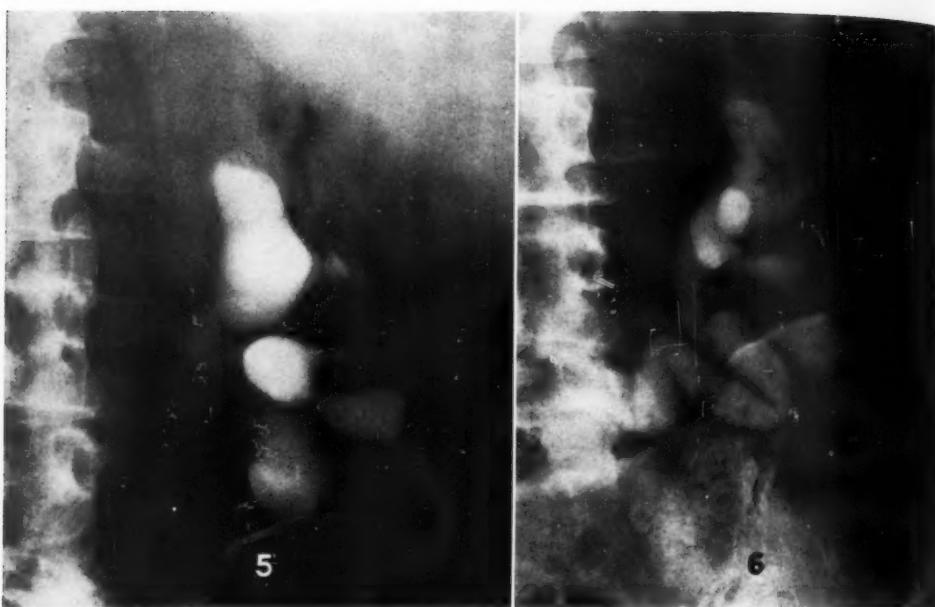
Figs. 3 and 4. Case II.

Fig. 3. Twenty-five-minute supine study. Poor visualization of the lower infundibulum.

Fig. 4. Twenty-five-minute prone study. The now dependent lower infundibulum is well demonstrated, showing absence of narrowing.

#### URETERIC VISUALIZATION

Although improved intravenous urographic technic—better contrast medium, abdominal compression, Trendelenburg position, and more meticulous patient preparation—has decreased the need for retrograde pyelography in many instances, there remains room for improvement in complete demonstration of the ureters. For their visualization, retrograde exam-



Figs. 5 and 6. Case III.

Fig. 5. Twenty-five-minute supine study. Dilatation of calyces and infundibula, with lack of opacification of the renal pelvis.

Fig. 6. Twenty-five-minute prone study. Good visualization of the renal pelvis and upper ureter, which are now dependent to the calyces.

ination is still widely used; supine studies immediately after the release of abdominal compression and erect studies have not been consistently helpful in this respect. Inasmuch as the general course of the ureter is anterior from the renal pelvis to the brim of the bony pelvis, it was hoped that the twenty-five-minute prone projection might improve ureteric visualization, with the heavier contrast-laden urine coursing downhill in the ureter. In most of the undilated and unobstructed ureters, the results have been disappointing, apparently because normal pelvic and ureteric peristaltic activity rather than gravity carries the opacified, well mixed urine toward the bladder. However, in the dilated ureter, the prone study has been helpful, apparently on account of the diminution or absence of peristaltic activity.

CASE V: A. R., a 33-year-old woman, with a history of a left ureteral lithotomy ten years previously, was admitted to the hospital because of left flank pain. The twenty-five-minute supine film (Fig. 9) shows marked left hydronephrosis with

very faint opacification of the left ureter. An oval zone of calcification, just to the left of the lower sacrum, represents a left ureteral calculus. On the prone view (Fig. 10) there is much better delineation of the dilated left ureter, although the improved opacification does not extend all the way down to the calculus, probably due to the fact that the lower portion of the ureter now follows a posterior course along the curve of the sacrum and thus is not dependent in the prone position.

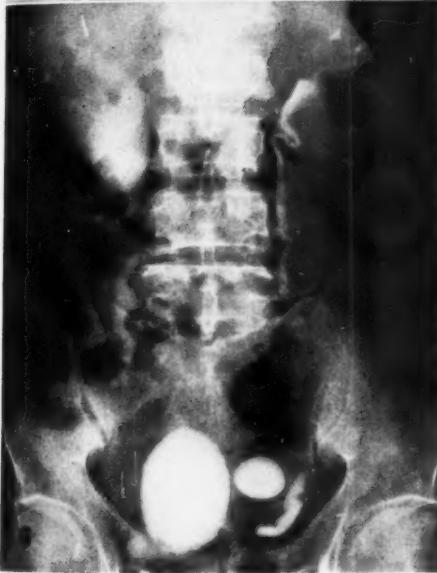
CASE VI: S. G., a 35-year-old man, had two days of right lower quadrant pain with radiation to the right flank. The twenty-five-minute supine study (Fig. 11) shows a right hydronephrosis with no opacification of the renal pelvis or of the upper ureter. The zone of calcification just to the right of the transverse process of L-3 probably represents a ureteral calculus, although in the absence of visualization of the ureter this cannot be definitely diagnosed. The prone view (Fig. 12) shows fairly good opacification of the ureteropelvic junction with visualization of the dilated upper ureter to the point of obstruction by the calculus. One might expect that an erect film (Fig. 13) would offer just as satisfactory a demonstration, but in that position the opacified urine fills the dependent calyces, with the rest passing by the incompletely obstructing calculus, leaving no opacification of the renal pelvis or upper ureter.

Fig.  
opaci  
but po  
region.  
Fig.  
heavie  
ent pe

Fig.  
opaci



7



9



10

Figs. 7 and 8. Case IV.

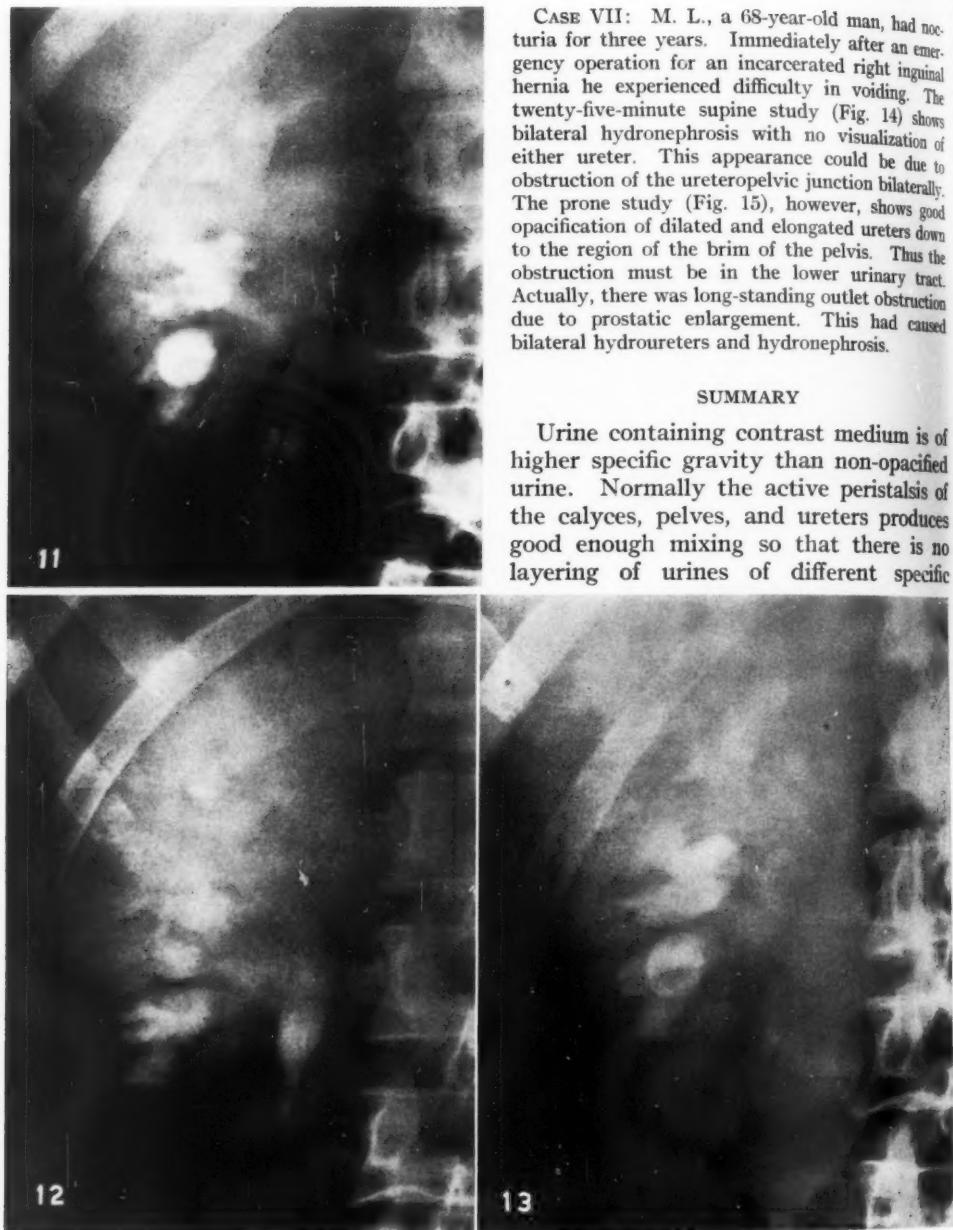
Fig. 7. Twenty-five-minute supine view. Good opacification of the calyces and infundibula on the right, but poor opacification of the pelvis and ureteropelvic region.

Fig. 8. Twenty-five-minute prone view. The heavier opacified urine has drained into the now dependent pelvis and upper ureter on the right.

Figs. 9 and 10. Case V.

Fig. 9. Twenty-five-minute supine view. Poor opacification of the markedly dilated left ureter down to the site of the ureteral calculus.

Fig. 10. Twenty-five-minute prone view. The upper two-thirds of the ureter is now dependent to the calyces and there is thus better opacification of the dilated ureter.



Figs. 11-13. Case VI.

Fig. 11. Twenty-five-minute supine study. Dilatation of calyces but no opacification of the pelvis or ureter so that the relationship of the calcification to the ureter cannot be determined.

Fig. 12. Twenty-five-minute prone study. The now dependent dilated upper ureter is filled, clearly demonstrating that the calcification is in the course of the ureter.

Fig. 13. Erect study. The upper ureter is now emptied of the opacified urine so that again the relationship of the calcification to the ureter is not demonstrated.

CASE VII: M. L., a 68-year-old man, had nocturia for three years. Immediately after an emergency operation for an incarcerated right inguinal hernia he experienced difficulty in voiding. The twenty-five-minute supine study (Fig. 14) shows bilateral hydronephrosis with no visualization of either ureter. This appearance could be due to obstruction of the ureteropelvic junction bilaterally. The prone study (Fig. 15), however, shows good opacification of dilated and elongated ureters down to the region of the brim of the pelvis. Thus the obstruction must be in the lower urinary tract. Actually, there was long-standing outlet obstruction due to prostatic enlargement. This had caused bilateral hydroureretes and hydronephrosis.

#### SUMMARY

Urine containing contrast medium is of higher specific gravity than non-opacified urine. Normally the active peristalsis of the calyces, pelvis, and ureters produces good enough mixing so that there is no layering of urines of different specific

Fig. 14. Study. Bi of either ureteropelvic illustration Albert Ein Eastchester New York

1. BAU Function Intravenous tember 1962. 2. ETI

Dec Urina contras que urin le perist ureteres de man

had no...  
an emer...  
inguinal...  
ing. The  
) shows  
ation of  
due to  
aterally.  
ows good  
rs down  
thus the  
y tract.  
truction  
caused

1 is of  
acified  
lsis of  
duces  
is no  
pecific



Fig. 14. Case VII. Twenty-five-minute supine study. Bilateral hydronephrosis without visualization of either ureter.

ureteropelvic regions, and the ureters. Illustrative cases are presented.

Albert Einstein College of Medicine  
Eastchester Road and Morris Park Ave.  
New York 61, N. Y.

#### REFERENCES

1. BAUMRUCKER, G. O.: Estimation of Renal Function Based on Specific Gravity Changes Following Intravenous Urography. *J. Urol.* **50**: 290-300, September 1943.
2. ETTINGER, A.: Layer Formation in Pyelogram.



Fig. 15. Case VII. Twenty-five-minute prone study. The now dependent, dilated upper ureters are well visualized.

raphy. *Am. J. Roentgenol.* **49**: 783-794, June 1943.

3. FEY, B., AND TRUCHOT, P.: Urographie intraveineuse en verticale d'une grosse poche d'hydronéphrose. *Bull. Soc. franç. d'urol.*, May 18, 1936, pp. 228-230.

4. HANDEL, J., AND SCHWARTZ, S.: Value of the Prone Position for Filling the Obstructed Ureter in the Presence of Hydronephrosis. *Radiology* **71**: 102-103, July 1958.

5. HELLMER, H.: Tactics and Technique for Urography. *Brit. J. Radiol.* **19**: 169-172, April 1946.

6. KEATES, P. G.: Physical, Physiological and Hormonal Aspects of Hydronephrosis. *J. Fac. Radiologists* **6**: 123-133, October 1954.

7. LEPOUTRE, C., AND MONNIER: A propos des niveaux horizontaux du liquide opaque dans l'urographie intraveineuse en verticale. *Bull. Soc. franç. d'urol.*, Nov. 16, 1936, pp. 287-296.

8. McLAUGHLIN, W. L., AND BOWLER, J. P.: Excretory Urography in the Diagnosis of Ureteropelvic Obstruction. *J. Urol.* **67**: 1012-1016, June 1952.

9. ROLLESTON, G. L., AND REAY, E. R.: The Pelvi-Ureteric Junction. *Brit. J. Radiol.* **30**: 617-625, December 1957.

#### SUMMARIO IN INTERLINGUA

#### Decubito Ventral in Urographia Intravenose, pro le Studio del Vias Supero-Urinari

Urina a contento de substantia de contrasto ha un plus alte gravitate specific que urina non-opacificate. Normalmente, le peristalse active de calyces, pelvis, e ureteres produce un sufficiente miscimento de maniera que il non occurre un stratification de urinas de differente gravitates

specific. Tamen, in le presentia de atonia—como in casos de obstruction o de anomalitates neurologic—un stratification de facto occurre. Le decubito ventral permette un meliorate opacification de differente portiones del sistemas de calyces, del regiones ureteropelvic, e del ureteres.

## Use of "Radiopaque Streamers" to Show Blood Currents in the Heart<sup>1</sup>

T. DOBY, M.D.

UNTIL NOW NO method has been devised to visualize the currents of the blood in the heart chambers and great vessels in a satisfactory manner (1). Some interesting studies of the course of radiopaque oil droplets are of great value (2, 3). Oil, however, produces embolization in experimental animals, which precludes its use in man. Also, the oil droplets are carried away from the site of study and observation for any length of time is not possible. The present angiographic technics, with rapid filling and gradual dilution of water-soluble radiopaque material, are inadequate for the study of blood currents except for the occasional visualization of jets through stenotic valves, etc. As the visualization of currents in the heart chambers could lead to the demonstration of valvular insufficiencies, shunts, etc., it was thought to be important to devise an appropriate method to achieve this goal.

Having these problems in mind, the author, while watching a yacht race, noticed the small banners and ribbons attached to the tips of the masts, floating in the wind, indicating its direction and strength. That a similar phenomenon might be induced in the heart chambers appeared likely. Several trials resulted in the design of streamers which, attached to the tip of a cardiac catheter, showed the direction of the blood currents in the heart. The method can be duplicated simply in any laboratory and used for animal experiments.

### PREPARATION OF STREAMERS

A fine nylon thread was chosen and the end frayed with a needle. The tip of the thread was then dipped into white lead (commercially used for painting). The droplet thus formed was allowed to dry for twenty-four hours, after which the

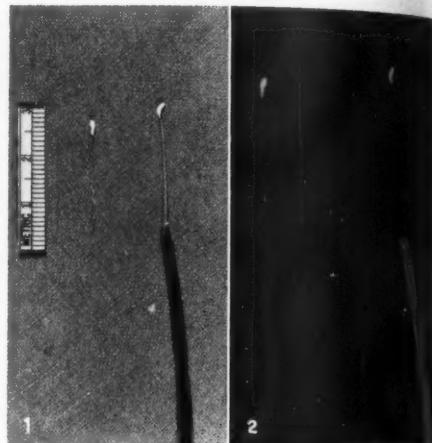


Fig. 1. Photograph of nylon thread with white lead droplet at the end. It is shown attached to the cardiac catheter at the right.

Fig. 2. Roentgenogram of streamer shown in Fig. 1. The nylon thread is nonopaque.

procedure was repeated. This gave a firm white lead deposit, approximately 2 by 0.5 mm., at the end of the nylon thread. The dry droplet was then dipped into Duco cement and was again dried for twenty-four hours. The glue gives a smooth surface which is important to prevent clotting of blood if applied in the cardiac chambers. The nylon thread so prepared was cut to the length desired and the cut end glued with Duco cement into the tip of the catheter (Figs. 1 and 2).

Several streamers of different lengths (1 to 3 cm.) can be attached to the end of a conventional cardiac catheter or polyethylene tube. As many as seven of these streamers were sometimes used, but most of the time the number was limited to one or two.

### METHOD OF APPLICATION

After sterilization of the catheter in white Zephran for six hours, the streamer

<sup>1</sup> From the Radiological Department of Yale University School of Medicine, New Haven, Conn., and Mercy Hospital, Portland, Maine. Accepted for publication in November 1960.

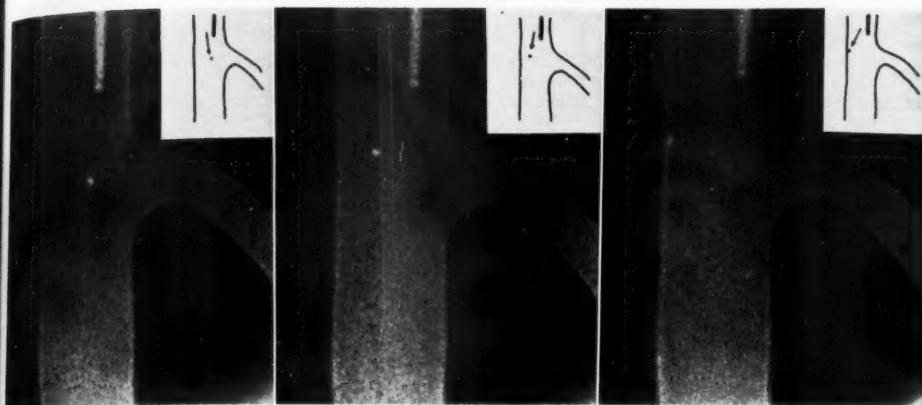


Fig. 3. A water current pouring from a narrow glass tube into a wider one pushes the streamer from the middle to the extreme left. X-ray cinefilm study through an image amplifier.

was dipped into heparin and the catheter was introduced into the femoral or brachial vein of the dog and forwarded into the right atrium and ventricle and finally into the pulmonary artery. During insertion the streamer lies by the side of the cardiac catheter but, immediately after it enters the heart chambers, it will be carried to and fro following the blood current. A cine film can be taken through an image amplifier and one can follow the movements of the radiopaque dot easily (4).

The withdrawal of the catheter is performed in the usual manner. Up to the present, the streamers have never caught between the chordae tendineae and clots have not been found on them after more than twenty minutes observation in the cardiac chambers. Whether this method

could be utilized in human diagnosis needs further examination.

ACKNOWLEDGMENT: I heartily acknowledge the assistance of Dr. R. M. Lowman, Associate Professor of Radiology at the Yale University School of Medicine.

131 State St.  
Portland, Maine

#### REFERENCES

1. DOBY, T.: Leonardo da Vinci's Heart Model and His Studies of Blood Currents. *J. Maine M. A.* **52**: 1-4, January 1961.
2. DOTTER, C. T., AND FRISCHE, L. H.: Radiologic Technique for Qualitative and Quantitative Study of Blood Flow. *Circulation* **18**: 961-970, November 1958.
3. STAUFFER, H.: Following of Lipiodol Droplet with Cine Film After Injection into the Inferior Vena Cava. Lecture given in the Radiology Department, Yale University School of Medicine, New Haven, Conn., April 1960.
4. DOBY, T., AND LOWMAN, R. M.: Demonstration of Blood Currents with Radiopaque Streamers. *Acta radiol.* **55**: 272-275, April 1961.

#### SUMARIO IN INTERLINGUA

#### Le Uso de Bandierolas Radio-Opac pro Demonstrar le Currentes del Sanguine in le Corde

Le autor ha elaborate un methodo unic pro sequer le currentes del sanguine in le cameras cardiac de animales experimental. Le terminos de filos de nylon es immersite in plumbo blanc pro render los opac. Le depositos radio-opac es alora revestite de glutine, e le filos es attachate al punctas de catheteres cardiac o de tubos de ethylene e

introducite assi via le vena femoral o brachial ad in le atrio e ventriculo dextere e finalmente ad in le arteria pulmonar. Illac, le va e veni del depositos radio-opac con le currentes del sanguine pote esser observate per medio de cinepelliculas e un intensificator de imagines. Le catheter es retirete in le maniera usual.

# EDITORIAL

## The Hazards of Medical Irradiation

Radiation is a toxic agent. This has been recognized for half a century as far as large quantities are concerned. The necrotizing effect on locally irradiated tissues and the lethal effect on the whole organism are known to layman and physician alike. The potential hazard of small exposures was first recognized from the cumulative effect noted in the pioneer radiologists, but again this involved large total doses. With further study the dose required to produce a recognizable effect has been found to be smaller and smaller. Even the low exposures in diagnostic procedures and the scattered radiation from therapeutic applications are not completely without hazard. The estimate that the medical use of radiation constitutes the single largest source of exposure to the population of this country has given rise to much concern.

Little is accurately known about the significance of small radiation doses. While there is evidence that exposure of certain parts of the body to as little as 5 to 10 rads may be damaging in some instances, the degree of this hazard, either to the individual or the population, is not clear. One of the basic sources of this confusion is the uncertainty that exists regarding the dose-effect relationship at very low levels. Virtually all of the experimental and clinical studies have been done at dose levels above 100 r, with extrapolation of the results to the low dose region.

There are several questions regarding the relation of dose to effect with small exposures that have not been satisfactorily answered. Is there a threshold dose that must be exceeded, *i.e.*, must a certain quantity of radiation be given before any effect is produced, or is the reaction "non-threshold" with respect to dose? Will re-

peated doses of radiation cumulate by simple summation or is there a more complex relationship? Will the same increase in dose always produce the same increase in effect (*i.e.*, is the relationship linear) or will the dose-effect relationship be more complex (nonlinear)? Until these questions can be answered, our information must remain qualitative rather than quantitative, and we are unable to assign accurate values to our estimates of hazard.

The induction of mutations as a result of radiation exposure is generally regarded as a linear, nonthreshold reaction, and the effects of repeated doses are thought to be cumulative by simple summation. Extensive studies of this genetic effect have been carried out in insects and small mammals. It is quite certain from the correspondence of effects in various species that the same qualitative effects occur in man, but the quantitative dose relationships remain uncertain. Estimates of the amount of radiation necessary to double the spontaneous mutation rate range from 20 to 80 or 100 rads. The greatest proportion of mutations are recessive; hence a mutated gene from one parent must join with a mutated gene from the other parent before the changed characteristic will be evident in the offspring. The frequency with which such junction can occur depends upon the number of mutations present in the breeding population. Thus the average radiation dose received by a breeding population is more important than that received by any one person. Mutation occurring after an individual's last child is conceived is of no significance either to the population or to his descendants.

Induction of neoplastic changes in body tissues is known to occur after exposure to moderate or large quantities of radiation.

The evidence that this can occur at low radiation rates and total doses is largely indirect and depends heavily on the assumption that the dose-effect relationship is linear at all levels and without threshold. Actually, on the basis of experimental studies of the induction of cancer and leukemia, there are equally good reasons for considering this relationship as nonlinear or having a threshold. At any rate, because neither situation can be proved, the possibility exists that doses in the diagnostic exposure range might contribute to the induction of neoplasia and that this must be taken into account as a possible hazard. There is reason to think that infants and children may be more sensitive in this respect and therefore justify special consideration.

Shortening of the life span of experimental animals has been observed after prolonged irradiation at low dose rates. This is nonspecific in character without preponderance of any particular lesion. Attempts to evaluate this effect in man by consideration of the relative longevity of radiologists and other physicians has been inconclusive. At the present time there are insufficient data regarding this reaction in man to permit any estimate of the significance of the phenomenon clinically. It can probably be disregarded as far as medical exposure is concerned, though it must still be considered in relation to occupational exposure.

Production of fetal damage by irradiation in early pregnancy appears to present a more significant hazard than those so far mentioned. Doses of 5 to 10 rads applied to the mother during the early cleavage phases of the fertilized ovum can be shown to reduce litter size in experimental animals. Such doses will also increase the incidence of malformation to a measurable degree in the surviving fetuses. There is a reduction in this sensitivity with time of gestation; it remains higher in the first trimester than during the remainder of pregnancy. Women in the child-bearing age who may be pregnant thus constitute a particular problem. The recommenda-

tion that radiation exposure to the pelvis be avoided in such women except during the time from the onset of menstruation to the time of ovulation seems well taken.

Despite these uncertainties, quantitative estimates of radiation hazard have been made which can serve as a guide in practice. The most generally accepted estimate concerning genetic effect is that exposure of the gonads to 50 rads will double the spontaneous rate of mutation. The number of abnormalities that will appear in a population depends on the number of mutated genes present. There is an equilibrium between mutation induction and spontaneous loss. Thus to double the number of mutationally produced abnormalities would require exposure of an entire population to an average dose of 50 rads for the twenty to thirty generations necessary to establish equilibrium. Estimation of leukemogenic hazard depends on acceptance of a linear, non-threshold relationship between dose and effect which is not on completely firm ground. On this basis, one can estimate that a dose of 30 rads to the whole hematopoietic volume would double the normal incidence of leukemia, *i.e.*, raise the probability of an individual's becoming leukemic from about 1:15,000 to 1:7,500. Insufficient data are available regarding other carcinogenesis to permit any estimate, however poor. The values given for the production of fetal abnormalities or abortion are minimum for the first two to four weeks of gestation. The apparent threshold value is about 15 to 20 r for the remainder of the first trimester and probably two or three times this amount for the remainder of gestation.

The most frequent source of radiation exposure in medicine is the diagnostic examination. Many studies have been made of this problem. Among the most striking observations that emerge from a study of these reports are the tremendous range of exposure that exists between one examination and another and the considerable variation of dose with variations in technic in the same type of examination. For ex-

ample, the ovarian dose may vary from a low of about 0.02 mr for a chest examination to a total of about 7,000 mr for pelvimetry. With different technics and radiographic factors, the fetal dose received during a complete pelvimeteric examination may vary from 2,000 mr to as high as 45,000 mr. Fluoroscopy presents some of the greatest possibilities for overexposure. The ovarian dose from an examination involving the pelvis may be as high as 30,000 to 40,000 mr when performed by an inexperienced examiner with unsuitable technic and antiquated equipment. The same examination carried out by an experienced fluoroscopist on good equipment will result in exposures of one-tenth of this amount or less.

Reduction of patient exposure is quite simple. Exclusion of the critical area from the direct beam by means of accurately adjusted diaphragms is more effective than any other factor. The use of high-kilovoltage technics and high-speed films and screens will reduce total exposure both in the beam and out. These should be employed whenever possible. Increased filtration at the tube-head is very effective in reducing skin exposure but has less effect on the dose received by tissues within the body. The addition of local shielding to the gonads adds rather little to the protection obtained from collimation, except where the reproductive organs are in the direct beam. Local shielding is helpful here if permitted by diagnostic considerations.

Very little information is available concerning exposure to the bone marrow. The meticulous and elegant studies that are being carried out by the physics group at Memorial Center in New York do much to dispel this lack. The reader is referred to the paper by Epp, Weiss, and Laughlin (1) which reports measurements of dose to the hematopoietic system resulting from chest examinations, and to a study by Holodny, Lechtman, and Laughlin on bone-marrow exposure during the application of radioactive materials to pelvic cancer (to appear in *RADIOLOGY* for July). These studies supply much needed data

for evaluation of marrow exposure and leukemia hazard.

General patient exposure resulting from therapeutic irradiation appears to present a lesser problem. The radiation beams used are small and well collimated. A very high proportion of patients receiving such treatment are beyond the age when reproduction is possible. The greatest use of radiation therapeutically is in the treatment of cancer. The danger to life from the patient's malignant tumor is much greater than that from the effects of radiation even if the possibility of the induction of cancer were much greater than it appears to be on clinical grounds.

Cancer is relatively rare in children and young adults, but this is the group in which gonadal exposure should be minimized. The papers by Kaplan, Collica, and Rubenfeld and by Gwinn, Gastineau, and Campbell in this issue of *RADIOLOGY* deal with the gonadal irradiation resulting from therapeutic application. The first presents tables relating gonadal exposure to field size and location for middle-energy x-rays. The value of local gonadal shielding is shown to be appreciable even with the well collimated beams used therapeutically. As would be expected, treatment of areas well removed from the gonadal region results in little genetic hazard. The paper by Gwinn *et al.* is concerned particularly with the irradiation of children. Using phantoms constructed to represent typical children of three ages, they studied gonadal dose from a variety of therapeutic procedures that had been used in their department. The dose received in the region of the reproductive organs in these various phantoms was quite low for most procedures. Treatment of the proximal femur in the male or the retroperitoneal region in the female were the only procedures delivering more than 50 rads to this critical area.

Very few objective data are available concerning the exposure received by the general population. The estimate that medical uses of radiation constitute the greatest source of such exposure, referred to earlier, is based on several assumptions.

The paper a measure which w exposure da record of one or more in su There tion expon associate have some individual the hum and cann tion avail for the medical The ste and inves and Radi fully, on these disc United St the Ameri of gr project or centers of in the for radiologis sufficient and Biolo surprised of excell field of R that man speci Accor Chairman Philip J. mission, have sug of progra interest now in e needed, good qu The ferring p as Radi

The paper by Morgan in this issue describes a measuring device that is simple to use which would permit the collection of exposure data on every patient receiving a diagnostic examination. A continuous record of such exposures on all patients in one or more departments would help materially in supplying population exposure data.

There is reason to suspect that radiation exposure even in the small amounts associated with diagnostic radiology may have some deleterious effects either on the individual or on the genetic constitution of the human race. The degree of this hazard cannot be defined from the information available. Each physician responsible for the operation of equipment used in medical radiology should make every effort

to use techniques that have been shown to reduce exposure, but should not hesitate to perform an examination that will be of clinical benefit to the patient. Particular care is necessary in the exposure of women in the reproductive age.

The use of radiation diagnostically and therapeutically is essential to the present-day practice of medicine. It should be used with care and with knowledge of the possible hazards. In this way it will continue to be of greater benefit than hazard.

ROBERT J. BLOOR, M.D.

#### REFERENCE

- EPP, E. R., WEISS, H., AND LAUGHLIN, J. S.: Measurement of Bone Marrow and Gonadal Dose from the Chest X-ray Examination as a Function of Field Size, Field Alignment, Tube Kilovoltage and Added Filtration. *Brit. J. Radiol.* **34**: 85-100, February 1961.

## Graduate Programs in the Radiological Basic Sciences

The steadily growing need for teachers, workers, and investigators in the fields of Radiation Physics and Radiation Biology has not been filled successfully, on the basis of the numerous vacancies in these disciplines in departments of radiology in the United States. The Commission on Education of the American College of Radiology undertook a survey of graduate, degree-conferring programs, projected or now in operation, in the various medical centers of this country, hoping to stimulate interest in the formation of new programs, to the end that radiologists might begin to have available to them a sufficient number of colleagues in the fields of Physics and Biology. The members of the Commission were surprised to find that there were far more programs of excellent character available than anyone in the field of Radiology had realized until that time, and that many of these programs were unknown to prospective trainees in these vital fields.

Accordingly, Earl R. Miller, M.D., the present Chairman of the Commission on Education, and Philip J. Hodes, M.D., past Chairman of the Commission, under whose direction this work was done, have suggested the publication of the following lists of programs and the dissemination of these lists to all interested prospective students. It will be of interest to the teacher and the practicing radiologist to observe the number and nature of these programs now in existence. Probably even more of them are needed, for there is always room for a new program of good quality in any field.

The following tables show graduate, degree-conferring programs only, classified by field of endeavor, as Radiation Biology, Radiation Physics, and Health

Physics, and as to the degree offered, with additional notation on a source of information on each program.

#### RADIATION BIOLOGY

Institution and Program Director	Degrees Offered	
	Master's	Doctor's
<i>Bowman Gray School of Medicine</i> Donald J. Pizzarello, Ph.D. Department of Radiology Bowman Gray School of Medicine Winston-Salem, N. C.	x	x
<i>University of Colorado Medical Center</i> Department of Radiology University of Colorado Medical Center Denver 20, Colo.	x	x
<i>Johns Hopkins University and Medical School</i> Russell H. Morgan, M.D. Radiologist-in-Chief The Johns Hopkins Hospital Baltimore 5, Md.	x	x
<i>University of Illinois College of Medicine</i> Roger A. Harvey, M.D. Department of Radiology University of Illinois College of Medicine Chicago 12, Ill.	x	x
<i>State University of Iowa School of Medicine</i> Titus C. Evans, Ph.D. Radiation Research Laboratory College of Medicine Iowa City, Iowa	x	x

## RADIATION BIOLOGY—cont.

Institution and Program Director	Degrees Offered	Master's Doctor's
<i>University of Pennsylvania School of Medicine</i> Mortimer L. Mendelsohn, Ph.D. Department of Radiology University of Pennsylvania Philadelphia 4, Penna.	x	x
<i>University of Rochester School of Medicine</i> Louis Hempelmann, M.D. Professor and Chairman Department of Radiology Strong Memorial Hospital Rochester 20, N. Y.	x	x
<i>State University of New York, Upstate Medical Center</i> William Fisher, Ph.D. Assistant Professor of Radiology 766 Irving Ave. Syracuse, N. Y.	x	x
<i>University of Texas Southwestern Medical School</i> Frederick J. Bonte, M.D. Professor and Chairman Department of Radiology The University of Texas Southwestern Medical School Dallas 35, Texas	x	
<i>Tulane University</i> John Hampton, Ph.D. Department of Physiology Tulane University New Orleans, La.	x	x
<i>Medical College of Virginia</i> William T. Ham, Jr., Ph.D. Department of Biophysics and Biometry Medical College of Virginia Richmond 19, Va.	x	x
<i>Washington University School of Medicine</i> Dr. Leonard J. Tolmach Associate Professor of Chemistry in Radiology Mallinckrodt Institute of Radiology 510 South Kingshighway Saint Louis 10, Mo.	x	x
<i>University of Wisconsin School of Medicine</i> L. W. Paul, M.D. Professor and Chairman Department of Radiology 1300 University Ave. Madison 6, Wisc.	x	

## RADIATION PHYSICS

Institution and Program Director	Degrees Offered	Master's Doctor's
<i>University of California at Los Angeles School of Medicine</i> Chairman, Department of Radiology School of Medicine Los Angeles 24, Calif.	x	x
<i>University of Chicago School of Medicine</i> Robert D. Moseley, Jr., M.D. Department of Radiology 950 E. 59th St. Chicago 37, Ill.	x	

## RADIATION PHYSICS

Institution and Program Director	Degrees Offered	Master's Doctor's
<i>College of Physicians and Surgeons Columbia University</i> H. H. Rossi, Ph.D. 630 W. 168th St. New York 32, N. Y.	x	
<i>Emory University School of Medicine</i> R. H. Rohrer, Ph.D. Department of Radiology Emory University School of Medicine Atlanta 22, Ga.	x	x
<i>University of Florida College of Medicine</i> John D. Reeves, M.D. J. Hillis Miller Health Center University of Florida Gainesville, Fla.	x	x
<i>Johns Hopkins University and Medical School</i> Russell H. Morgan, M.D. Radiologist-in-Chief The Johns Hopkins Hospital Baltimore 5, Md.	x	x
<i>University of Illinois College of Medicine</i> Roger A. Harvey, M.D. Department of Radiology University of Illinois College of Medicine 840 South Wood Street Chicago 12, Ill.	x	x
<i>State University of Iowa School of Medicine</i> Titus C. Evans, Ph.D. Radiation Research Laboratory College of Medicine Iowa City, Iowa	x	x
<i>Memorial Hospital, New York</i> John S. Laughlin, Ph.D. Department of Biophysics Sloan-Kettering Institute 410 E. 68th Street New York 21, N. Y.	x	x
<i>University of Minnesota Medical School</i> Merle Loken, Ph.D. Department of Radiology University of Minnesota Hospitals Minneapolis 14, Minn.	x	x
<i>University of Pennsylvania School of Medicine</i> John Hale, Ph.D. Department of Radiology University of Pennsylvania Philadelphia 4, Penna.	x	x
<i>University of Rochester School of Medicine</i> Louis Hempelmann, M.D. Professor and Chairman Department of Radiology Strong Memorial Hospital Rochester 20, N. Y.	x	x
<i>University of Texas Southwestern Medical School</i> Frederick J. Bonte, M.D. Professor and Chairman University of Texas Southwestern Medical School Dallas 35, Texas	x	

## RADIATION PHYSICS

Institution and Program Director	Degrees Master's	Offered Doctor's
<i>University of Utah School of Medicine</i> Dr. Thomas T. Dougherty College of Medicine University of Utah Salt Lake City, Utah	x	x
<i>Medical College of Virginia</i> Richard G. Lester, M.D. Professor and Chairman Department of Radiology Medical College of Virginia Richmond 19, Va.	x	x
<i>Washington University School of Medicine</i> Michel Ter-Pogossian, Ph.D. Associate Professor of Biophysics Molinckrodt Institute of Radiology 510 South Kingshighway Saint Louis 10, Mo.	x	x
<i>University of Wisconsin School of Medicine</i> L. W. Paul, M.D. Professor and Chairman Department of Radiology 1300 University Ave. Madison 6, Wisc.	x	

## HEALTH PHYSICS

Institution and Program Director	Degrees Master's	Offered Doctor's
<i>Johns Hopkins University and Medical School</i> Russell H. Morgan, M.D. Radiologist-in-Chief The Johns Hopkins Hospital Baltimore 5, Md.	x	x
<i>University of Illinois College of Medicine</i> Milan Novak, M.D., Ph.D. Associate Dean Graduate College, University of Illinois Chicago, Ill.	x	x

## HEALTH PHYSICS

Institution and Program Director	Degrees Master's	Offered Doctor's
<i>Memorial Hospital, New York, N. Y.</i> John S. Laughlin, Ph.D. Professor and Chairman Department of Biophysics Sloan-Kettering Institute 410 E. 68th Street New York 21, N. Y.	x	x
<i>University of Michigan School of Medicine</i> Professor C. J. Velz Department of Environmental Health University of Michigan School of Public Health Ann Arbor, Mich.	x	x
<i>University of Minnesota Medical School</i> Merle Loken, Ph.D. Department of Radiology University of Minnesota Hospitals Minneapolis 14, Minn.	x	x
<i>University of Pennsylvania School of Medicine</i> Richard H. Chamberlain, M.D. Department of Radiology University of Pennsylvania Philadelphia 4, Penna.	x	x
<i>University of Rochester School of Medicine</i> Louis Hempelmann, M.D. Professor and Chairman Department of Radiology Strong Memorial Hospital Rochester 20, N. Y.	x	x
<i>Medical College of Virginia</i> Richard G. Lester, M.D. Professor and Chairman Department of Radiology Medical College of Virginia Richmond 19, Va.	x	x
FREDERICK J. BONTE, M.D., F.A.C.R. For the Commission on Education of the American College of Radiology		

## IN MEMORIAM



DAVID M. GOULD, M.D.

1914-1961

Without warning of any kind, Dr. David M. Gould died of a myocardial infarction on April 2, 1961. His quiet strength and genuine regard for his fellow man were such that all who knew him will mourn his loss as that of a close personal friend, no matter how casual their relationship.

Dr. Gould was born in Worcester, Mass., on Jan. 29, 1914. He attended Classical High School in Worcester and received his A.B. from Clark University in 1935. Upon graduation from college, he entered the Harvard Medical School, where he was awarded the M.D. degree in 1939. After serving as an intern at the Boston City Hospital from 1939 to 1941, he was commissioned a Lieutenant in the U. S. Public Health Service. During the war years he saw service in Europe, by 1945 reaching the rank of Surgeon (Major). He was assigned to duty with the United Nations Relief and Rehabilitation Administration in 1945, and in 1947 was sent to the Johns Hopkins Hospital to pursue further training in Radiology. He was appointed to the

Johns Hopkins University Faculty as an Assistant Professor in 1949 and was promoted to Associate Professor in 1950. During his years at Hopkins he won the universal respect and regard of his colleagues for his keen clinical skills and for his fine personal qualities.

In 1956, Dr. Gould was asked to become Professor and Head of the Department of Radiology at the new University of Arkansas Medical Center in Little Rock. He remained there until September 1959, at which time he went to the University of Colorado to assume a comparable post. In his three years at Arkansas he developed an outstanding department which was widely recognized for its teaching, service, and research programs. At the University of Colorado, he again exhibited his remarkable ability in revitalizing the Department of Radiology. Despite limitations of budget and space, he created a superior program in a remarkably short time. Dr. Gould was particularly effective in attracting able young men to the field of radiology, and the

loyalty of all his staff, both professional and non-professional, testified to his qualities of leadership and to his warmth as a human being.

He served as President of the Radiological Society of Baltimore and as Secretary-Treasurer and, later, as President of the Association of University Radiologists. In 1955 he was Exchange Professor at Guy's Hospital Medical School in London, and lectured at Edinburgh Medical School and at Lund University Medical School in Sweden. He was a member of the Radiological Society of North

America, American Roentgen Ray Society, American College of Chest Physicians, American Association of University Professors, Association of University Radiologists, American Medical Association, American Association for the Advancement of Science, American College of Radiology, American Society of Nuclear Medicine, and Rocky Mountain Radiological Society.

Dr. Gould is survived by his wife, Libby; three sons, Daniel, Richard, and Alan; two brothers and four sisters.

MARVIN L. DAVES, M.D.

---

## ANNOUNCEMENTS AND BOOK REVIEWS

### MISSOURI RADIOLOGICAL SOCIETY

The newly formed Missouri Radiological Society has installed the following officers: President, Gwilym S. Lodwick, M.D., Columbia; President-Elect, Wendell G. Scott, M.D., St. Louis; Secretary-Treasurer, Milton Shoss, M.D., 937 Broadway, Cape Girardeau.

### NEW YORK ROENTGEN SOCIETY

Newly chosen officers of the New York Roentgen Society are: President, William B. Seaman, M.D.; Vice-President, Albert A. Dunn, Jr., M.D.; Secretary, Bernard S. Wolf, M.D., 11 E. 100th St., New York 29, N. Y.; Treasurer, Harry Mellins, M.D.; Historian, Ramsay Spillman, M.D.; Member of Executive Committee, Frank J. Borrelli, M.D.

### VERMONT RADIOLOGICAL SOCIETY

The Vermont Radiological Society has recently elected A. Bradley Soule, M.D., as President. Other officers are Ira Rowlison, M.D., Vice-President, and John R. Williams, M.D., 46 Nichols St., Rutland, Secretary.

### WESTCHESTER RADIOLOGICAL SOCIETY

Recently elected officers of the Westchester (New York) Radiological Society are: Jacque E. Miller, M.D., Yonkers, President; Lucille M. Bond, M.D., Mount Vernon, Vice-President; Anthony A. Maglione, M.D., 27 Ludlow St., Yonkers, Secretary.

### ROCKY MOUNTAIN RADIOLOGICAL SOCIETY MIDSUMMER CONFERENCE

The twenty-third Midsummer Radiological Conference of the Rocky Mountain Radiological Society will be held Aug. 10-12, 1961, at the Denver-Hilton Hotel, Denver, Colo. The guest speakers will be Harold G. Jacobson, M.D., Montefiore Hospital, New York, N. Y.; Walter T. Murphy, M.D., Roswell Park Memorial Institute, Buffalo, N. Y.; William B. Seaman, M.D., Columbia-Presbyterian Medical Center, New York, N. Y.

On Friday, Aug. 11, the Society will honor Dr. Eugene Pendergrass, on the year of his retirement, for his outstanding contributions to radiology. The program on that day will consist of papers by Dr. Pendergrass' former residents and at the annual banquet he will be awarded a plaque commemorating the occasion. A plaque will also be presented to Dr. H. Milton Berg, Bismarck, N. D., in recognition of his years of faithful service to the Society and of his many contributions to medicine and radiology.

Further information regarding the Conference

may be obtained from Raymond W. Hammer, M.D., Chairman, Publicity Committee, 808 Republic Bldg., Denver 2, Colo.

### SOCIETY OF NUCLEAR MEDICINE PITTSBURGH CHAPTER

At the recent annual meeting of the Society of Nuclear Medicine, Pittsburgh Chapter, the following officers were elected: Paul M. Meadows, M.D., President; David L. Chamovitz, M.D., Vice-President; Edward J. Pavsek, M.D., Department of Radiology, Mercy Hospital, Pittsburgh 19, Secretary-Treasurer.

### COMBINED CONFERENCES ON MEDICAL ELECTRONICS AND ON ELECTRICAL TECHNIQUES IN MEDICINE AND BIOLOGY

The Fourth International Conference on Medical Electronics will be held jointly with the Fourteenth Annual Conference on Electrical Techniques in Medicine and Biology, July 16-21, 1961, at the Waldorf-Astoria, New York, under the sponsorship of the Joint Executive Committee on Medicine and Biology of the Institute of Radio Engineers, the American Institute of Electrical Engineers, and the Instrument Society of America.

In addition to the presentation of papers, a program of tours and visits will be arranged to the Columbia-Presbyterian Medical Center, Columbia University, the Columbia University Plainsboro Nuclear Reactor, the VA Hospital, the Brookhaven National Laboratory, the Prudential Insurance Company of America Computer Center, and the IBM Research Center.

Further information may be obtained from Walter E. Tolles, Airborne Instruments Laboratory, Deer Park, N. Y.

### EIGHTH INTERNATIONAL CANCER CONGRESS

The Eighth International Cancer Congress will be held at the Moscow State University, Moscow, USSR, July 22-28, 1962, under the sponsorship of the International Union Against Cancer. Papers are invited on experimental and clinical aspects of cancer and on cancer control. Both the application for reading a paper and an abstract not exceeding 250 words must be submitted not later than Nov. 1, 1961, the original and two copies to be sent to Moscow and an original and five clearly legible copies to the USA National Committee on the International Union Against Cancer. Special facilities will be available for motion pictures and technical exhibits, a brief description of which should also be submitted. The registration fee is \$30.00 if sent before April 1, 1962.

Travel allotments will be available to a limited number of scientists and physicians in the United States who may require such assistance. Applications for such allotments should be addressed to the Chairman, USA National Committee on the International Union Against Cancer, 2101 Constitution Ave., N.W., Washington 25, D.C.

Further information and application forms may be obtained from Dr. Harold F. Dorn, General Secretary, International Union Against Cancer, National Institutes of Health, Bethesda 14, Md., or from Prof. L. M. Shabad, General Secretary, Soviet National Organizing Committee, Academy of Medical Sciences of the USSR, 14 Soljanka, Moscow, USSR.

#### AMERICAN CANCER SOCIETY SCIENTIFIC SESSION

The 1961 Scientific Session of the American Cancer Society will be held at the Biltmore Hotel, New York, N.Y., Oct. 23-24, 1961, in conjunction with the American Cancer Society's Annual Meeting. The topic for discussion will be "The Physician and the Total Care of the Cancer Patient."

Further information may be obtained from Professional Education Section, American Cancer Society, 520 W. 57th St., New York 19, N.Y.

#### Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

**ROENTGENOLOGY OF INTRACRANIAL MENINGIOMAS.** By SIDNEY P. TRAUB, M.D., Associate Professor of Radiology, University of Saskatchewan College of Medicine; Assistant Director of Radiology, University Hospital, Saskatoon, Canada; Honorary Consultant Radiologist, Saskatchewan Cancer Commission; Formerly, Fellow in Neuro-radiology, Montreal Neurological Institute, Montreal, Canada. With an Introduction by Donald L. McRae, Montreal Neurological Institute, Montreal, Canada. A volume of 238 pages, with 128 figures. Published by Charles C Thomas, Springfield, Ill., 1961. Price \$14.00.

**DISEASES OF THE INTERVERTEBRAL DISC AND ITS SURROUNDING TISSUES.** By REUBEN RABINOVITCH, B.A., M.Sc., M.D., Assistant Professor in Neurology and Neurosurgery, McGill University, Faculty of Medicine, Montreal; Assistant Neurologist, The Department of Neurology and Neurosurgery, The Royal Victoria Hospital and The Montreal Neurological Institute. A volume of 152 pages, with 79 figures. Published by Charles C Thomas, Springfield, Ill., 1961. Price \$8.50.

**THE PATHOLOGY OF IONIZING RADIATION.** By SHIELDS WARREN, M.D., Sc.D., LL.D., Professor of Pathology, Harvard Medical School at the New England Deaconess Hospital; Pathologist, New England Deaconess and New England Baptist Hospitals, Boston, Mass. A monograph of 42 pages, with 17 figures. Published by Charles C Thomas, Springfield, Ill., 1961. Price \$3.00.

**DAS RÖNTGENBILD DES HERZENS.** By Dr. D. ROUTIER, Paris. With a Foreword by PROF. DR. W. Duchosal, Geneva. German translation from the French (Ed. de Visscher, Brussels, 1956) by DR. P. VON DESCHWANDEN, Adelboden, and DR. W. O. ZÜRCHER, Basel. A brochure of 70 pages, with 16 figures. Published by Georg Thieme, Herdweg 63, (14a) Stuttgart, Germany, 1961. Price DM 5.80 (\$1.45). Distributed in the United States and Canada by the Intercontinental Medical Book Corporation, New York 16, N.Y.

#### Book Reviews

**DIAGNOSTIC ROENTGENOLOGY OF THE DIGESTIVE TRACT WITHOUT CONTRAST MEDIA: A MOUNT SINAI HOSPITAL MONOGRAPH.** By BERNARD S. WOLF, M.D., Director, Department of Radiology, The Mount Sinai Hospital, New York; Associate Clinical Professor of Radiology, Columbia University, MANSHO T. KHLNANI, M.B., Associate Fellow in Radiology, The Mount Sinai Hospital, New York, and ARTHUR LAUTKIN, M.D., Associate Radiologist, The Mount Sinai Hospital, New York; Associate Radiologist, Flower & Fifth Avenue Hospitals; Associate Clinical Professor, New York Medical College. A volume of 180 pages, with 245 figures. Published by Grune & Stratton, New York 16, N.Y., 1960. Price \$8.75.

One of the satisfactions which comes to the radiologist is the pleasure of making an unexpected observation or diagnosis to the confounding of his clinical colleagues. All are familiar with the recognition of the gastric fundal neoplasm on chest roentgenograms. Less well known appearances of inflammatory and neoplastic diseases of the gastrointestinal tract in plain film examinations of the abdomen are discussed and illustrated in this monograph from Mount Sinai Hospital. There are separate chapters devoted to the stomach, small bowel, and colon, with specific sections on the various disease entities that can be recognized. A generous use is made of illustrations, and the quality of the reproductions is excellent. The book is highly recommended to all who interpret films of the abdomen.

**RAYONS X, RADIO-ISOTOPES ET E. E. G. DANS L'ÉPILEPSIE.** Edited by MM. H. FISCHGOLD and H. GASTAUT. Fédération internationale d'électro-encéphalographie et de neurophysiologie clinique (7<sup>e</sup> Colloque de Marseille, 1958). Suppl. 17, Electroencephalography and Clinical Neurophysi-

ology, an International Journal. A volume of 266 pages, with 117 figures, 4 plates, and 44 tables. Published by Masson & Cie, 120, Boulevard Saint-Germain, Paris, 6<sup>e</sup>, France, 1960. Price 65 NF.

This collection of papers from a symposium on the relations between morphologic and electroencephalographic data in epilepsy, held in Marseille, France, in October 1958, contains many papers dealing mainly with electroencephalography, and therefore not of primary interest to the radiologist. Among the radiological papers is one by D. L. McRae of Montreal, on the radiologic signs in epilepsy. Of interest are some of the plain film findings in this disease associated with unilateral cerebral atrophy. These include unilateral flattening of the cranial vault, localized thickening, decreased size of the various fossae, etc. Dr. McRae reports a study of 100 patients admitted for head trauma with no neurological problem. Twenty-five of these showed slight flattening and localized thickening on the left, while 9 showed a similar finding on the right. This raises the interesting question as to whether, in 25 per cent of patients, the left side of the brain is less developed. There is also a brief account of calcifications associated with epilepsy, small tumors associated with epilepsy, and the various forms of

cerebral atrophy. In the discussion of this paper, Dr. Fischgold mentions the value of tomography in the evaluation of the temporal fossa in cases of localized atrophy. This may be the only way in which the changes can be demonstrated.

In the discussion of another paper Dr. McRae expresses the opinion that one cannot make the diagnosis of cortical atrophy on radiological grounds alone. Sometimes in children the sulci may appear large at encephalography but be normal on inspection, and *vice versa*. He feels that a diagnosis of cortical or generalized atrophy cannot be made before the age of five.

Among the other subjects included are hemiplegia associated with atrophy, epilepsy in childhood, and epilepsy associated with vascular malformations, with cranial stenosis, and following surgery for a meningioma. One paper of some interest is that on gamma encephalography (GEG) in the diagnosis of epilepsy in adults, by Drs. T. Planiol and Fischgold. Using  $^{131}\text{I}$ -tagged serum albumin, they obtained positive localization of 134 out of 153 tumors. They feel that, if the electroencephalogram and the gamma encephalogram are both negative, the possibility of tumor as the cause of epilepsy is less than 5 per cent. If both are positive, the probability of tumor is more than 80 per cent.

#### ERRATUM

Through an unfortunate error, in the paper by Hemley, Arida, Diggs, and Freeman, "Percutaneous Cricothyroid Membrane Bronchography," in the May issue of *RADIOLOGY*, two figures on page 763 were transposed. The sentence beginning in the twenty-second line of the second column should read: "A 16-gauge beveled needle, 1 1/2 inches in length, is attached to a 2-c.c. syringe containing 2 c.c. of 1 per cent Pontocaine Hydrochloride."

The Head  
KRUWIF, E  
raphy  
KOIVISTO, J  
genol  
grams  
Deter  
Di CHIROP  
mensi  
BAKER, H  
Their  
KUHN, R  
bral A  
FRIEDEN  
ment  
Norm  
gram  
MATSUBA  
A Si  
Obse  
McRAE,  
norm  
RUBEN,  
Air  
Pati  
AGATI, C  
diol  
Lary

The Che  
ROQUE,  
BANFI, A  
Lyn  
The He  
LAUER,  
Ver  
tric  
SEITCHI  
cer

The Di  
BOCCAC  
Ra  
sion  
MEYER  
Cin  
Di  
QUILLI  
sis  
BARBER  
Fo  
BOOK,  
fo

## ABSTRACTS OF CURRENT LITERATURE

### ROENTGEN DIAGNOSIS

#### The Head and Neck

KRUYFF, EVERT. Some Remarks on Encephalography.....  
983

KONVISTO, E., ET AL. A Method for Roentgenologic Measurements from Spot Fluorograms. Its Application to Skull Capacity Determination.....  
983

DI CHIRO, GIOVANNI. The Width (Third Dimension) of the Sella Turcica.....  
983

BAKER, HILLIER L., JR. Intracranial Sarcomas: Their Roentgenographic Manifestations.....  
984

KUHN, ROBERT A. The Normal Brachial Cerebral Angiogram.....  
984

FRIEDENBERG, RICHARD M., ET AL. Measurement of the Anterior Cerebral Artery in Normal and Abnormal Cerebral Arteriograms.....  
984

MATSUBARA, TOSHIO, AND NOMURA, TAKAYOSHI. A Sign of Cerebral Ventricular Dilatation Observed in Carotid Phlebograms.....  
985

MCRAE, DONALD L. The Significance of Abnormalities of the Cervical Spine.....  
985

RUBEN, H., ET AL. X-Ray Study of Passage of Air Through the Pharynx in Anaesthetised Patients.....  
986

AGATI, G., AND ADAGLIO, L. Clinical and Radiologic Considerations on Symptomatic Laryngocoele.....  
986

#### The Chest

ROQUE, F. T. A New Face of Tuberculosis.....  
986

BANFI, ALBERTO. Pulmonary Manifestations of Lymphogranulomatosis.....  
987

#### The Heart and Blood Vessels

LAUER, RONALD M., ET AL. Obstruction of Left Ventricular Outlet in Association with Ventricular Septal Defect.....  
987

SEITCHIK, MURRAY W., ET AL. Studies in Visceral Arteriography.....  
987

#### The Digestive System

BOCCACCIO, R., AND RIZZO, V. Clinical and Radiologic Considerations on Acute Occlusions of the Small Intestine.....  
987

MEYER, WILLIAM G. Intravenous Cholecysto-Cholangiography in Emergency Abdominal Diagnosis.....  
988

#### The Musculoskeletal System

QUILLIN, RALPH C. Roentgenographic Diagnosis of Arthritis.....  
988

BARBER, H. STUART. An Unusual Form of Familial Osteodystrophy.....  
988

BOOK, J. A., AND SANTESSON, BERTA Malformation Syndrome in Man Associated with Triploidy (69 Chromosomes).  
988

### Gynecology and Obstetrics

MACARINI, N., ET AL. Pelvic Arteriography in Gynecologic Conditions.....  
988

GOODLIN, ROBERT C., ET AL. Intravenous Placentalography.....  
989

WESTON, W. J. Radiographic Demonstration of Gartner's Ducts.....  
989

AGATI, G., AND PRIGIONE, D. Roentgen Investigation of Pregnancy with Triplets, Including a Twin Thoracopagus.....  
989

### The Genitourinary System

OWEN, R. H. The Concentration of Pyelographic Contrast Media. A Radiographic Method of Estimation of Renal Function...  
989

STALEY, CHARLES J. Retrograde Ileopyelography.....  
990

SMIDY, F. G., AND ANDERSON, G. K. Tolerance of the Kidneys to the Contrast Medium Urografin.....  
990

LAUBSCHER, W. M. L., AND RAPER, F. P. A Report of a Case of the Injection of a Massive Dose of Urografin into the Renal Artery....  
990

### Miscellaneous

DONNER, MARTIN W., AND McAFFEE, JOHN G. Roentgenographic Manifestations of Diabetes Mellitus.....  
991

### RADIOTHERAPY

MCWHIRTER, ROBERT. Measurement of the Value of Treatment in Malignant Disease....  
991

BOAG, J. W. Statistical Problems Which Arise in Cancer Therapy.....  
991

CAMPBELL, JAMES B., AND HUDSON, FRANK M. Craniobuccal Origin, Signs, and Treatment of Craniopharyngiomas.....  
991

MASSOUD, G. E., AND AWWAD, H. K. Nasopharyngeal Fibroma: Its Malignant Potentials and Radiation Therapy.....  
992

BLOEDORN, FERNANDO G., AND COWLEY, R. ADAMS. Irradiation and Surgery in the Treatment of Bronchogenic Carcinoma.....  
992

AMBESI IMPIOMBATO, G., ET AL. Treatment of Carcinoma of the Cervix with Radium and Telecobalt.....  
993

### RADIOISOTOPES

FEDOR, E. J., AND FISHER, BERNARD. The Use of Radioactive Iodine Labeled Triolein in the Evaluation of Fat Absorption Following Cholecystectomy.....  
993

SCHTEINGART, DAVID E., ET AL. Effect of Diuretics Upon the Serum Protein Bound Iodine and the Thyroidal Uptake of Radioactive Iodine.....  
994

VERLOOP, M. C., ET AL. Radioactive Iron Studies in Patients with Iron Deficiency Anemia with Concurrent Abnormal Hemolysis.....	994	GARCIA, JOHN, AND KIMELDORF, DONALD J. Some Factors Which Influence Radiation-Conditioned Behavior of Rats.....	996
BADENOCH, JOHN, AND CALLENDER, SHEILA T. Effect of Corticosteroids and Gluten-Free Diet on Absorption of Iron in Idiopathic Steatorrhoea and Celiac Disease.....	994	MURPHREE, R. L., AND PACE, H. B. The Effects of Prenatal Radiation on Postnatal Development in Rats.....	996
BRODY, EUGENE A., ET AL. The Kinetics of Intravenously Injected Radioactive Vitamin B <sub>12</sub> : Studies on Normal Subjects and Patients with Chronic Myelocytic Leukemia and Pernicious Anemia.....	994	MARTIN, EDGAR J. Hypothermia and Ischemia of the Bone Marrow as Protection Against Injury by Whole-Body X-Irradiation in Rats.....	997
GLAD, B. W., ET AL. Strontium Studies in Beagles.....	995	DJERASSI, ISAAC, ET AL. Survival of Total-Body X-Irradiated Mice after Delayed Infusions of Isologous Bone Marrow.....	997
JELLIFFE, A. M., AND JONES, K. M. Thyroid Cancer After Irradiation in Adult Life.....	995	NEBEL, BERNARD R., AND MURPHY, CAROL J. Damage and Recovery of Mouse Testis after 1000 r Acute Localized X-Irradiation, with Reference to Restitution Cells, Sertoli Cell Increase, and Type A Spermatogonial Recovery.....	997
SCHWARZ, ENRIQUE, ET AL. A Universal Gonadal Shield.....	995	CATTANEO, S. M., ET AL. DNA Synthesis in Irradiated Hair Follicles of the Mouse.....	997
ALLEN, RALPH G., ET AL. Acute Effects of Gamma Radiation in Primates.....	995	BRUNST, V. V. Reaction of Limb Regenerates of Adult Axolotl to X-Irradiation.....	998
IRVING, CHARLES C., AND PERKINSON, JESSE D., JR. Biochemical Effects of Internal Irradiation.....	996	BACHOFER, C. S., AND GAUTEREAUX, M. E. Biologic Activity of Mammalian Nerves During X-Irradiation.....	998
KIMELDORF, D. J., ET AL. Radiation-Induced Conditioned Avoidance Behavior in Rats, Mice, and Cats.....	996	UHR, JONATHAN W., AND SCHARFF, MATTHEW. Delayed Hypersensitivity. V. Effect of X-Irradiation on the Development of Delayed Hypersensitivity and Antibody Formation..	998

J.  
n.  
.. 996  
cts  
p.  
.. 996  
ia  
st  
in  
997  
l.  
997  
r  
h  
l  
997  
998  
998  
998  
998

## ROENTGEN DIAGNOSIS

### THE HEAD AND NECK

**Some Remarks on Encephalography.** Evert Kruyff. *Am. J. Roentgenol.* **84:** 38-47, July 1960. (105 Stephen Drive, Toronto, Ont., Canada)

This article is largely a description of an encephalographic technic based on the Swedish method (Lindgren: *Acta radiol. suppl.* 151, 1957. *Abst. in Radiology* **71:** 599, 1958). Among the points made are the following: (1) Preliminary skull films are indispensable, since one is often confronted with unsuspected, spontaneous pathologic air fillings, calcifications, or decalcifications, and/or asymmetries which may remain hidden. (2) Lumbar puncture is preferred over suboccipital tap. (3) Withdrawal of a minimum of cerebrospinal fluid with insufflation of varying amounts of air make for good toleration of the procedure. Thirty to 60 c.c. of air is instilled with removal of, at most, one quarter this volume of fluid; the air is insufflated fractionally with the patient sitting upright.

After the cisterns and ventricles are filled, the patient is allowed to lie down, and lateral, anteroposterior, and semi-axial films are made in both prone and supine positions. The temporal horns are filled individually and anteroposterior and lateral films of each are taken. The examination is not considered complete unless the cisterns and sulci are filled as well as the ventricles.

Discomfort is minimal with this method and the procedure is considered harmless if correct precautions are taken. The examination is contraindicated in acute vascular disease, but the author feels that good results can be obtained in the presence of increased pressure and threat of herniation. The method is regarded as superior to ventriculography in that it clearly defines the anatomic relationships in the posterior sulci, unless, of course, the patient is unable to co-operate or is in a subcomatose state.

The article concludes with a brief description of some of the anatomic relations seen on the roentgenograms obtained.

Fourteen roentgenograms. **PHILLIP SISK, M.D.**  
Indiana University Medical Center

**A Method for Roentgenologic Measurements from Spot Fluorograms. Its Application to Skull Capacity Determination.** E. Koivisto, L. Pyykönen, and C. Wegelius. *Am. J. Roentgenol.* **84:** 96-98, July 1960. (Norrtull's Hospital, Stockholm Va, Sweden)

For determining skull capacity, MacKinnon *et al.* (*Am. J. Roentgenol.* **76:** 303, 1956). *Abst. in Radiology* **69:** 128, 1957) used two roentgenograms—an anteroposterior and a lateral—basing their estimate on the following formula:

$$V = (1/2 \times L \times H \times W) + (1/2 \times L \times B \times W) \times 0.51$$

where  $V$  = skull capacity,  $L$  = maximum internal anteroposterior diameter,  $H$  = height measured from midway between the projections of the external auditory meatuses to the farthest point on the inside vault of the skull,  $B$  = bregma posterior-craniot fossa diameter, and  $W$  = maximum internal breadth.

The present authors adapted this method for use with spot fluorograms, and report a study of 113 patients. The fluorograms were made with the Odelca

x-ray mirror camera. Small lead balls were taped to the frontal region and occiput for the postero-anterior fluorogram and balls were taped to the parietal regions at the points of maximum external width of the skull for the lateral fluorogram. The distance between these balls was measured with calipers prior to the x-ray examination. The fluorograms obtained were magnified to a degree such that the distance between the markers equaled the distance measured on the patient. Other measurements were then made directly from the fluorograms.

The average skull volume in the material studied was 1,438 c.c., which is only 2.6 per cent greater than the average obtained by MacKinnon and his associates.

Two roentgenograms; 2 drawings, 1 table.

**CHARLES H. HELMEN, M.D.**  
Indiana University Medical Center

**The Width (Third Dimension) of the Sella Turcica.** Giovanni Di Chiro. *Am. J. Roentgenol.* **84:** 26-37, July 1960. (National Institute of Neurological Diseases and Blindness, Bethesda 14, Md.)

The lateral view of the skull affords information as to the length and height (depth) of the sella turcica. Its width has never been roentgenographically demonstrated. Some have advocated that the (semi-axial) Towne view be used for this measurement, but this is open to certain objections.

Actually the desired dimension may be obtained from the standard postero-anterior roentgenogram of the skull. The floor of the sella is demonstrable in over 90 per cent of the examinations (in 100 per cent with added laminography). The sellar floor appears as a plateau and is usually flat or concave, rarely convex. The landmarks used for measurements are the highest points of the lateral edges of the plateau. In a convex plateau or a plateau in which the landmarks are hard to visualize, the author suggests using the distance between two ideal lines continuing cranially from the lateral walls of the sphenoid sinus.

Normal measurements in adults showed that in 50 per cent the width of the sella is 13 or 14 mm.; the lowest figure obtained was 9 mm. and the highest 18 mm. Ten normal children under five years of age showed a width of 10 to 13 mm. The figures were not corrected for magnification, which was figured to be 10 per cent at a 36-inch focal distance.

The advantages of a three-dimensional study are: (1) better evaluation of an enlarged sella; (2) recognition of the floor of the sella; (3) objective study of an asymmetric sella; (4) better evaluation of early erosion due to increased intracranial pressure; (5) accurate knowledge of the lateral boundaries of the sella; (6) more adequate evaluation of borderline sellae.

With three diameters of the sella available, it is possible, with some limitations, to calculate the volume of the pituitary. The sella may, however, enlarge independently of pituitary enlargement, as a result of tumors of the epipharynx and sphenoid sinus, dilatation of the third ventricle, parasellar tumors and aneurysms, and increased intracranial pressure. Conversely, the pituitary is enlarged in pregnancy without sellar enlargement.

In calculating the sellar volume, the author assumes that the shape is ellipsoid and uses the formula:

volume equals  $(4\pi/3) \times 1/2$  the length,  $1/2$  the width, and  $1/2$  the height.

In comparison with actual volume determinations the roentgen estimates of pituitary size were found to be low. This is attributed to the fact that the pituitary is not a perfect ellipsoid. The following simple method of determining the pituitary volume from the sellar measurements is suggested. The product of the length, width, and height of the sella as obtained roentgenographically is divided by 2,000. A correction factor of 0.5112 is used to convert the roentgenographic volume to actual pituitary volume.

In measuring the length of the sella, the most distal points of the cortical outline of the anterior wall of the sellar cavity and the anterior aspect of the dorsum sellae are used. The height is obtained by measuring the distance between the midpoint of a line drawn between the tips of the tuberculum sellae and the dorsum sellae, and the lowest point of the floor.

Thirty roentgenograms; 2 drawings; 4 tables.

MICHAEL A. KYLE, M.D.  
Indiana University Medical Center

**Intracranial Sarcomas: Their Roentgenographic Manifestations.** Hillier L. Baker, Jr. Am. J. Roentgenol. 84: 70-77, July 1960. (The Mayo Clinic, Rochester, Minn.)

The author reports 54 cases of intracranial sarcoma encountered since 1945 at the Mayo Clinic. Perivascular sarcomas accounted for 21 cases, of which 17 were in females, and fibrosarcomas for 19 cases (16 in males). Other types were reticulum-cell sarcoma, 6 cases; hemangiopericytoma, 5; miscellaneous, 3. The majority of the tumors (45) were supratentorial. The sex distribution was equal, and the age range from two months to sixty-five years. Growth rate was slow to extremely rapid.

Plain skull films were positive for an intracranial neoplasm in 70 per cent of the cases, most frequently in the fibrosarcoma (15 of 19), reticulum-cell sarcoma (5 of 6), and miscellaneous (3 of 3) groups. Findings were nonspecific, however, with indirect signs of intracranial mass, bone destruction, or calcification. The latter was of an amorphous, conglomerate type.

Angiography located the tumor in 9 of 10 examinations. A picture considered pathognomonic of sarcoma was present in 2 of these. This consisted of a "gliomatous type" of vascularity accompanied by demonstration of some blood supply by the internal and external carotid systems. The author also describes a pneumographic finding which he feels is highly suggestive of sarcoma and only rarely seen in gliomas. This was observed in 9 of 27 air-contrast studies, consisting in invasion of the ventricular wall characterized by spontaneous communication of the ventricle with an adjacent cyst having an irregular ragged lining, or replacement of the usual smooth ventricular wall by a similar zone of irregularity.

Eighteen roentgenograms; 2 tables.

WILLIAM H. BAKER, M.D.  
Indiana University Medical Center

**The Normal Brachial Cerebral Angiogram.** Robert A. Kuhn. Am. J. Roentgenol. 84: 78-87, July 1960. (25 Franklin St., Morristown, N. J.)

In view of the frequency of asymptomatic segmental arterial lesions in the general population, it has become necessary that a safe, reliable angiographic technic be

developed to visualize not only the cervical carotid bifurcations but the major thoracic trunks upon which the cerebral circulatory tree stands. Retrograde brachial cerebral angiography reliably opacifies two-thirds of the cerebral circulation from its source to the collecting veins. The vertebral-basilar system is regularly filled with contrast material under conditions approximating the physiologic normal for the individual. The common and internal carotid arteries are sharply opacified throughout their courses. Roentgenologic visualization of ascending and descending segments of the cerebral circulatory tree is obtained by use of a film-changing device. The technic of the procedure is described in detail, and the normal vascular anatomy is discussed, with excellent diagrams and roentgenograms.

The trauma accompanying percutaneous puncture of arteries is eliminated and accurate and comfortable positioning of the patient is possible. There has been no morbidity or mortality accompanying this procedure.

The author's study is based on more than 200 brachial angiograms.

Sixteen roentgenograms; 4 diagrams; 1 photograph.  
RICHARD JONTZ, M.D.  
Indiana University Medical Center

**Measurement of the Anterior Cerebral Artery in Normal and Abnormal Cerebral Arteriograms.** Richard M. Friedenberg, Jerome H. Shapiro, Berta M. Rubinstein, Murray J. Rosenzweig, A. B. A. Siegelbaum, and E. Lawrence Ganter. Am. J. Roentgenol. 84: 88-92, July 1960. (Lebanon Hospital, New York 57, N. Y.)

Measurements were made of the anterior cerebral artery on normal and abnormal cerebral angiograms, with special attention to the segment that curves around the genu of the corpus callosum. Eight different measurements were originally used in a study of 97 apparently normal cerebral angiograms and 27 of patients with confirmed space-occupying frontal lobe lesions. Only two measurements, on the lateral film, were found to be significant in differentiating the normal from the abnormal angiogram: (1) a line drawn from a point on the pericallosal artery 1 cm. posterior to the highest point on the genu of the corpus callosum, perpendicular to the inner table of the skull; (2) a line drawn from the most anterior point of the floor of the anterior fossa to the point on the genu closest to the anterior cerebral artery.

Statistical analysis of these two measurements indicates that individual cases show too much variation and overlap to permit separation of normal and abnormal cerebral angiograms. Groups of abnormal and normal studies show less variation, however, permitting some useful applications. The first of the two measurements is probably most valuable in everyday work. It not only reflects the position of the corpus callosum, but also may be used to measure an upward or downward shift of the pericallosal artery by a space-occupying lesion. In addition, this vessel reflects the size of the underlying lateral ventricle.

A line which is shorter than average, in the absence of other signs of a space-occupying lesion, would suggest a dilated ventricle.

One drawing; 4 graphs.

GERALD J. KURLANDER, M.D.  
Indiana University Medical Center

**A Sign of Cerebral Ventricular Dilatation Observed in Carotid Phlebograms.** Toshio Matsubara and Takayoshi Nomura. *Am. J. Roentgenol.* **84:** 93-95, July 1960. (3-32 Nishizaki-cho, Chikusa-ku, Nagoya, Japan)

The authors have been interested in estimating the degree of lateral ventricular dilatation in internal hydrocephalus angiographically so as to obviate the necessity for contrast filling of the ventricular system. Arteriograms do not meet the need, for the degree of anterior cerebral artery convexity and the upward and forward displacement of the sylvian artery group are not proportionate to the size of the hydrocephalic ventricle.

Cerebral phlebograms, however, provide a method for estimating the degree of dilatation. The origins of the vein of the septum pellucidum and the vein of the thalamostriatum with its tributaries form a convex curve which delineates the upper margin of the anterior and parietal portions of a lateral ventricle in the lateral view. These veins are stretched in proportion to the degree of lateral ventricular dilatation.

The authors present lateral phlebograms from four proved cases of internal hydrocephalus to illustrate the proportional stretching of these veins.

RICHARD J. NOVEROSKE, M.D.  
Indiana University Medical Center

**The Significance of Abnormalities of the Cervical Spine.** Donald L. McRae. *Am. J. Roentgenol.* **84:** 3-25, July 1960. (Montreal Neurological Institute, Montreal 2, Quebec, Canada)

This paper was presented as the Caldwell Lecture at the American Roentgen Ray Society Meeting for 1959. It is an excellent review of the roentgen abnormalities of the cervical spine which may appear in asymptomatic as well as symptomatic persons. Since the cervical spinal cord is often involved in independent neurologic diseases, the radiologist must determine whether the pathological changes in the spine correspond with the level of signs and symptoms of the cord disease in order that he may be able to assay properly their significance.

Bony abnormalities about the foramen magnum frequently produce neurologic symptoms. In chronic atlanto-axial dislocation, the odontoid process may compress the spinal cord against the posterior ring of the atlas. Even a few millimeters of sagittal dislocation can produce symptoms. Lateral films in full flexion and extension are advisable to study this condition and its association with complex abnormalities of the cranial vertebral junction.

Separate odontoid process of the axis is an anomaly sometimes leading to a diagnosis of congenital absence of the odontoid. Symptoms and signs, in a considerable proportion of cases, are due to concomitant atlanto-axial dislocation.

Occipitalization of the atlas also causes signs and symptoms of a lesion at the cranial vertebral junction in about half of the cases. The odontoid process often lies partly or wholly within the foramen magnum. Pressure against the lower medulla may come from the odontoid, the posterior arch of the atlas, the posterior lip of the foramen magnum, or the dura. Patients showing an anteroposterior diameter from the odontoid process to the posterior arch of less than 19 mm. usually have symptoms.

Basilar invagination, while not an abnormality of

the cervical spine, presents a differential problem. It is difficult if not impossible to make this diagnosis through the use of the basal angle or Chamberlain's and MacGregor's lines because of the marked developmental variations. Other bony anomalies in this area are anterior and posterior spondyloschisis. In the latter, absence of the posterior wall of the spinal canal is seen at C-1 in the lateral view. Lateral defects in the posterior arch of the atlas are rather rare and seldom of clinical importance. Asymmetry of the lateral facets is not uncommon and by itself is probably not significant.

Complex fusions of the upper cervical vertebrae may or may not lead to central nervous symptoms. The demonstration of atlanto-axial dislocation or of a small effective foramen magnum in these cases indicates potential, if not actual, compression of the neuraxis. In about half of the author's cases of occipitalization of the atlas, fusion of C-2 and C-3 were seen.

The Klippel-Feil syndrome is not always associated with central nervous system abnormalities, even though the spine and spinal cord develop together. Actually, patients with this syndrome surviving to adulthood are usually free of central nervous system symptoms and signs. Hypermobility of the spine at levels adjacent to the fused segments may, however, lead to excessive disk degeneration with posterior protrusion and secondary spinal cord disease.

Defective closure of the neurenteric canal may result in an adhesion, cyst, or canal connecting a part of the gastrointestinal or respiratory tract with the spine. This possibility should be given special consideration in the presence of a spinal anomaly involving the vertebral bodies or disks.

Cervical disk lesions, osteoarthritis, or spondylosis may lead to disease of the spinal cord and pressure on the nerve roots. The osteophytes in Marie-Strümpell arthritis form about normal disks following the course of the annulus fibers. With disk degeneration or rupture, the cervical vertebral bodies come together; their lateral edges almost touch, and there is curving of the annulus fibers. The lateral osteophytes follow these curves and assume the shape of hooks (*unci*). The spaces between them are called uncovertebral or Luschka joints. Narrowing of the disk spaces between C-5 and C-6 or C-6 and C-7 is present in more than 50 per cent of spines after the age of forty, with an equal frequency of symptomatic and asymptomatic patients. Apophyseal joint arthritis is probably not secondary to disk degeneration, but the two conditions may occur simultaneously, causing double jeopardy to the nerve roots.

The size of the bony canal must also be considered. Most commonly, smallness of the spinal canal in the anteroposterior diameter is a developmental variant. The fourth, fifth, and sixth cervical vertebrae are most frequently involved. This condition contributes to cervical spondylosis with paraplegia.

In assessing abnormalities of the cervical spine, ordinary roentgenograms are not enough. Myelography with sufficient oil to fill the cervical spinal canal completely or almost completely must be carried out before final and complete roentgenologic opinion is given.

Forty-one roentgenograms; 3 photographs; 4 drawings; 6 tables. JOHN A. CAMPBELL, M.D.

Indiana University Medical Center

**X-Ray Study of Passage of Air Through the Pharynx in Anæsthetised Patients.** H. Ruben, N. Bentzen, and S. K. Saev. *Lancet* 1: 849-852, April 16, 1960. (Anesthesiology Centre, Copenhagen, Denmark)

An investigation was performed to establish the influence of the position of the head and jaw on the patency of the air passage at the level of the tongue. Twenty-one patients, all under general anesthesia before operation, curarized, and deeply relaxed and apneic, were examined radiographically in the supine position. Twelve of the 21 were similarly studied when awake.

In 12 patients lateral views were obtained in the following 3 positions during anesthesia and when awake: (1) with the head tilted back by maximal extension in the upper part of the cervical spine; (2) with the head in normal position; (3) with the neck flexed, the head supported by a pillow 8 cm. high.

Since, with deep relaxation, the mouth opens during backward tilting of the head, the mouth was closed in 10 patients examined in this position, by pushing up the chin in the midline. In 11 patients lateral views were obtained during tilting of the head and studies were also made during application of the following maneuvers: (1) the mouth closed by pushing the chin up against the maxilla; (2) the mandible pushed forward by pressure applied forcefully on both sides behind the ramus of the mandible; (3) the mandible pulled forward forcefully with a finger in the patient's mouth behind his lower front teeth. To find out the importance of extension itself, in 6 patients radiographs were obtained during these same 3 maneuvers, but with the head in the normal position. Finally, in a few cases roentgenograms were made during anesthesia with the head hanging over the edge of the operating table.

In the unconscious patient the air passage through the pharynx was usually maintained by moving the mandible forward. Patency was obtained by merely tilting the head back, thereby producing extension of the upper part of the cervical spine. When, in addition, the mouth was closed, clearance was substantially increased. This method has been effective clinically in anesthetized patients during spontaneous respiration as well as during apnea; it has proved of practical importance when a face mask is used during anesthesia; it has been employed during expired-air resuscitation. Laymen learn this technic more easily than that of the usual forward displacement of the jaw.

Three roentgenograms with accompanying diagrams; 1 table.

**Clinical and Radiologic Considerations on Symptomatic Laryngocoele.** G. Agati and L. Adaglio. *Ann. radiol. diag.* 32: 464-480, 1959. (In Italian) (Istituto di Radiologia dell'Università di Torino, Italy)

A laryngocoele is formed by abnormal dilatation of the ventricular appendix of the larynx, which herniates either intra- or extralaryngeally, while a narrow stalk maintains its communication with the larynx. A prerequisite is the existence of a ventricular appendix (found in up to 30 per cent of individuals), to which must be added a local condition (disease) which causes a rise in intralaryngeal pressure, and finally a valve mechanism to inflate the sac.

In the 5 cases reported here (all in males of thirty-eight to fifty-two years) the laryngocoele resulted from, and was actually a symptom of, the underlying disease:

in 3 instances carcinoma (one of them with stenosis), in 1, infiltrative tuberculosis, and in the other non-specific laryngitis.

On plain roentgen studies of the neck, the laryngocoele is visible as a well defined, rounded, or oval radiolucent area. It is best seen on frontal stratigraphic sections. The *internal* laryngocoele, often identified also on direct or indirect laryngoscopy, may have to be differentiated from simple hypertrophy of the ventricular band, from inflammatory ventricular prolapse, localized edema, gumma, fibromatous polyp, benign tumor (angioma, chondroma, myxoma), etc. The air content of the sac is its major roentgen feature, but at times the sac may be filled with exudate.

The *external* laryngocoele is fairly easy to recognize by the localized swelling, momentarily exacerbated during cough, but otherwise depressible on palpation. It may be confused with a pocket of subcutaneous emphysema, as seen after accidental perforation of the larynx, or with enlarged lymph node(s), thyroid cyst, diverticulum of the cervical esophagus, or branchial cyst. *Mixed* and *pseudo-mixed* laryngocoeles may have to be distinguished also from congenital laryngeal cysts. Again, body-section roentgenography will be helpful in their identification.

In 1940, V. Fortunato, an Italian radiologist, injected for diagnostic purposes iodinated oil into a laryngocoele, and the resulting inflammatory reaction was followed by obvious shrinkage (cure!). This procedure has remained an accepted treatment method, especially for the external types, except that the substance currently used is 10 per cent tri-chlor-acetic acid. The alternative is surgical excision, the possibility of which must be considered only after careful evaluation of the underlying laryngeal (and/or systemic) disease.

Thirteen roentgenograms; 3 drawings; 1 photograph. E. R. N. GRIGG, M.D.

Cook County Hospital, Chicago

## THE CHEST

**A New Face of Tuberculosis.** F. T. Roque. *Am. J. M. Sc.* 240: 17-20, July 1960. (U. S. Army Hospital, Redstone Arsenal, Huntsville, Ala.)

With the use of high doses of isoniazid combined with para-aminosalicylic acid and/or streptomycin, the infiltrations seen on the roentgenograms of patients with pulmonary tuberculosis may clear so rapidly that in some cases the diagnosis has been changed to bacterial pneumonia. Complete clearing may occur in about thirty days. The danger of mistaking this rapidly clearing tuberculosis for pneumonia is great, especially if the etiologic organisms cannot be recovered. This is the "new face of tuberculosis," the subject of this paper.

Four cases are reported, 3 of pulmonary tuberculosis and 1 of tuberculous pleural effusion. In these cases the pulmonary infiltrations cleared as fast as ordinary pneumonia, if not faster. The disease was of recent development, and the patients had not been treated previously with chemotherapy for tuberculosis. The remarkably rapid clearing of infiltrations may not occur in re-treatment cases and is not expected in disease which is old and predominantly nodular as revealed in the roentgenograms.

Six roentgenograms. JOHN F. RIESSE, M.D. Springfield, Ohio

**Pulmonary Manifestations of Lymphogranulomatosis.** Alberto Banfi. Radiol. med., Milan 45: 1153-1181, December 1959. (In Italian) (Istituto di Radiologia dell'Università di Milano, Italy)

In the archives of the Radiological Institute of the University of Milan there were found 236 cases listed under the heading Hodgkin's disease. Among these were 34 (14.4 per cent), all histologically confirmed, with pulmonary lesions visible on the roentgenogram. In all instances, the lung had become involved only after other organs had harbored the disease.

There is no set time in the course of Hodgkin's disease at which pulmonary lesions appear. They were found in early as well as in terminal cases. Two types are recognized: one which extends from the mediastinum into adjacent lung parenchyma, presumably through contiguity; the other with isolated, rounded, ill defined foci in the lungs, most likely propagated by way of hemolymphatic channels. Both are at times associated with pleural effusion or with atelectases, of dubious etiology, possibly nonspecific in nature.

Pulmonary lesions do not necessarily indicate a shorter survival time for the patient with Hodgkin's disease. Their response to roentgen therapy is almost always gratifying, even though the final outcome of the systemic condition remains inevitable.

Thirty-one roentgenograms; 2 graphs; 4 tables.

E. R. N. GRIGG, M.D.

Cook County Hospital, Chicago

## THE HEART AND BLOOD VESSELS

**Obstruction of Left Ventricular Outlet in Association with Ventricular Septal Defect.** Ronald M. Lauer, James W. DuShane, and Jesse E. Edwards. Circulation 22: 110-125, July 1960. (The Mayo Clinic, Rochester, Minn.)

Rarely, left ventricular outflow tract obstruction is encountered in the course of surgical repair of a ventricular septal defect. In a pathological collection of 722 congenital heart lesions the authors found this association 10 times. These cases are presented in the framework of a classification relating hemodynamics to the position of the obstruction and the size of the ventricular defect.

Preoperative diagnosis in these cases is difficult if not impossible. While the auscultatory, roentgenographic, electrocardiographic, and heart-catheterization findings obtained by the usual methods may readily establish the presence of the septal defect, they may not reveal the existence of the associated obstruction to the left ventricular outlet. Isolated obstruction of left ventricular outflow may be suspected clinically when a murmur suggesting a stenotic lesion is heard in the aortic area, especially when the electrocardiogram shows evidence of left ventricular hypertrophy of the "systolic overload" type. With one exception, however, the murmurs in the authors' series were not recognized as those usually occurring with obstruction to left ventricular outflow.

Cardiac catheterization can be helpful, depending on the relationship of the septal defect and the stenosis.

Five roentgenograms and 10 photographs, with accompanying electrocardiograms.

ZAC F. ENDRESS, M.D.  
Bloomfield Hills, Mich.

**Studies in Visceral Arteriography.** Murray W. Seitchik, Marvin Poll, Eugene L. Komrad, and Ivan D. Baronofsky. Surg., Gynec. & Obst. 111: 192-196, August 1960. (Mount Sinai Hospital, New York, N.Y.)

A method for retrograde femoral aortography in the dog with high contrast visualization of the visceral branches is described. In 28 arteriograms on 18 dogs, visualization of the hepatic artery and its branches was consistently achieved. The authors' investigation established that selective visualization of the visceral aortic branches can be obtained by placement of the intra-aortic catheter adjacent to the branch orifice. A prerequisite for success is retrograde delivery of the contrast medium. A bolus of medium, when forced cephalad against the aortic current, localizes for a longer period in the vicinity of the catheter tip than when delivered from above. Much of the bolus, assisted by the elastic recoil of the aorta, is forced laterally into the adjacent branches. Relating the image of the intra-aortic catheter to a fixed point on the lumbar vertebral column provides a reliable means for positioning the catheter. Cauldwell and Anson's table giving the relationship between vertebral bodies and origin of aortic branches in man (Am. J. Anat. 73: 27, 1943), as determined from the dissection of 300 consecutive cadavers, is reproduced.

Techniques which involve advancement of the catheter into individual aortic branches produce the ultimate in high contrast visualization with small amounts of contrast medium. These procedures, however, require considerable experience, and significant amounts of irradiation are received by the patient and the operator. In the method described by the authors, the catheter may be positioned rapidly and with a minimum of trauma to the aorta. This is particularly appreciated in atherosomatous disease of that vessel. Atheromas frequently occur near the origins of the aortic visceral branches, and attempts to catheterize these vessels may produce thrombo-embolism. It is the avoidance of these dangers which justifies the slightly greater amount of contrast medium employed in the technic described.

Four roentgenograms.

JOSEPH M. WINSTON, M.D.  
University of Pennsylvania

## THE DIGESTIVE SYSTEM

**Clinical and Radiologic Considerations on Acute Occlusions of the Small Intestine.** R. Boccaccio and V. Rizzo. Ann. radiol. diag. 32: 379-422, 1959. (In Italian) (Istituto di Radiologia dell'Università di Genova, Italy)

Distention of the small intestine due to *dynamic [adynamic] ileus* is caused by "nervous" disturbances. It may be direct (as in peritonitis, and pancreatic and gynecologic forms), indirect (as following trauma), or reflex (as in extra-abdominal conditions, e.g., pleurisy, pneumonitis, or myocardial infarction). This type of ileus cannot be regarded as an acute occlusion, but it is at times present (as a segmental variety) in mechanical obstructions.

*Spastic ileus* is a rare type, seen in psychotic patients and others with neurovegetative imbalance. It comes on with sudden, diffuse abdominal cramping: after several days, again without any demonstrable cause, transit is restored, and there is no further

difficulty until the next episode, which may take place months or years later.

*Mechanical ileus* may be due to extra-intestinal causes, either (a) with mesenteric lesions, as hernia (abdominal, diaphragmatic, umbilical) and volvulus (of the entire small intestine on its mesentery, or isolated torsion of a single jejunal or ileal loop), or (b) without mesenteric lesions, mainly as a result of adhesions, whether congenital or post-surgical. The intra-intestinal causes are also divided into those with and without mesenteric involvement. The chief mesenteric condition is intussusception (due to benign tumor, Meckel's diverticulum, hypertrophic ileocecal valve, foreign bodies such as the Miller-Abbott tube, or chronic ulcerations, as in typhoid fever), either ileo-ileal or ileo-colic, very rarely involving other segments. Among intra-intestinal causes of mechanical obstruction without mesenteric lesions are all sorts of tumors and foreign bodies; gallstone ileus is in this group.

Twenty-three roentgenograms.

E. R. N. GRIGG, M.D.  
Cook County Hospital, Chicago

**Intravenous Cholecysto-Cholangiography in Emergency Abdominal Diagnosis.** William G. Meyer. *Ohio State M. J.* 56: 933-936, July 1960. (St. Anthony Hospital, Columbus, Ohio)

Intravenous cholecysto-cholangiography is of value in the differentiation of acute cholecystitis from other acute abdominal conditions, especially acute appendicitis. The procedure consumes but two hours and can be performed even though the patient is vomiting.

Normal intravenous cholecystograms were obtained in 7 cases of clinically suspected and pathologically confirmed acute appendicitis and in 1 case of acute duodenal ulcer. In 3 cases the findings on emergency cholecystography were abnormal; conservative management was employed, with improvement in the patient's condition.

Emergency intravenous cholecysto-cholangiography proved accurate in 11 cases, 8 of non-biliary and 3 of biliary disease.

Six cases are reported in detail.

Two roentgenograms. JOHN F. RIESSE, M.D.  
Springfield, Ohio

#### THE MUSCULOSKELETAL SYSTEM

**Roentgenographic Diagnosis of Arthritis.** Ralph C. Quillin. *J. Kentucky State M. A.* 58: 807-811, July 1960. (Lexington Clinic, Lexington, Ky.)

The fundamental radiographic manifestations of the more common arthritides are discussed. Descriptions are given of the usual radiographic signs of rheumatoid arthritis (including rheumatoid spondylitis and juvenile rheumatoid arthritis), gouty arthritis, osteoarthritis, articular manifestations of the collagen diseases, psoriatic arthritis, and suppurative arthritis.

A case report of suppurative arthritis in a twenty-six-month-old white male is presented. There was pain and swelling of the right shoulder, with x-ray evidence of widening of the shoulder joint. Antibiotic therapy was administered. Serial films revealed development and subsidence of osteomyelitis of the humerus with clinical absence of symptoms in one month.

Six roentgenograms.

JOHN F. RIESSE, M.D.  
Springfield, Ohio

**An Unusual Form of Familial Osteodystrophy.** H. Stuart Barber. *Lancet* 1: 1220-1221, June 4, 1960. (Withington Hospital, Manchester, England)

A familial condition of dwarfism occurring in 4 brothers is reported. The spine and hips were the only parts affected, the spine showing a remarkable fusion. The hands were not affected nor were the knees abnormal. The onset seems to have occurred shortly before puberty. Dr. J. F. Brailsford, whose help in interpreting the roentgenograms was sought, believed that the condition was not osteochondrodystrophy but a familial disorder not hitherto described.

All the 8 siblings of the original patient, who was unmarried, and all the children of 1 of the affected brothers were examined radiographically. Three brothers and 2 sisters were of normal size, but 1 of the sisters had rheumatoid arthritis. One of the affected brothers had 2 children and another 11, all of whom appeared to be developing normally.

Six roentgenograms; 2 photographs.

**Malformation Syndrome in Man Associated with Triploidy (69 Chromosomes).** J. A. Book and Berta Santesson. *Lancet* 1: 858-859, April 16, 1960. (University of Uppsala, Sweden)

A case is reported of a boy nearly a year old when first seen by the authors because of recurrent attacks of fever combined with disturbances of consciousness. Malformations had been present since birth, with subsequent retarded development and occasional feeding difficulties. The child was unable to raise his head when lying flat on his back. He showed some interest and played with toys but in general contact was deficient. He was small for his age and had localized lipomatosis on the back of the hands, feet, and thighs, thin lower legs, hypoplastic jaws (micrognathia) and cutaneous as well as bony syndactyly of the hands and feet. The internal organs appeared normal. The genitals were normal for the patient's size and age. The reflexes were normal but a peculiar pattern of movements, including some ataxic features, was observed.

On radiographic examination 9 bone nuclei were found in the skeleton instead of the expected 16. No teeth had erupted but germs were present. A pneumoencephalogram showed good filling of the ventricles with no displacement or deformity, but the basal cistern was much dilated and large air spaces were observed bilaterally over the frontal convexity and partially on the right side. The radiologist's diagnosis was porencephaly.

Chromosome studies disclosed that practically all acceptable metaphases ( $>25$ ) contained 69 chromosomes; occasional cells with lower or higher numbers were observed. The findings indicated the presence of three haploid sets, i.e., a chromosome complement of  $3A + XXY$ .

Two figures.

#### GYNECOLOGY AND OBSTETRICS

**Pelvic Arteriography in Gynecologic Conditions.** N. Macarini, M. Scursatone, and N. Zinicola. *Radiol. med.*, Milan 45: 1041-1069, November 1959. (In Italian) (Istituto di Radiologia dell'Università di Genova, Italy)

Pelvic arteriography is performed with the patient under general anesthesia (to avoid vasospasm), with a

rubber bandage (Esmarch) tightened around the root of the thigh. A 7-cm. needle is introduced percutaneously, "against the current" through the inguinal-femoral area into the external iliac artery. The amount of tri-iodinated contrast medium to be injected is not specified, but the syringe recommended has a capacity of 30 c.c. Rapid injection will result in retrograde penetration of the contrast material into the common iliac artery and aorta with production of a pelvic angiogram. It is preferable to perform the procedure during the menstrual cycle, at which time more vessels will be visualized (because of the inherent congestion). Indeed, Borell reported a case in which an ovarian tumor was visible only during menstruation.

In uterine fibromyoma, the uterine artery is enlarged proportionally with the size of the tumor; if the latter is very large, the parametrial trajectory of the artery becomes angulated. Extrinsic (capsular) vessels have a semilunar aspect, which is quite characteristic. The mass of the tumor does not opacify prior to the capillary phase. The appearance of fibromyoma is usually typical, but small tumors may be difficult to identify.

The findings in the presence of malignant lesions are different: (1) early visualization of the tumor bed, with irregular ("anarchic") vascular ramifications; (2) lacunar opacities within the tumor, due to vascular lakes (this is also encountered in non-neoplastic conditions with rapid increase in vascular supply, as in the placenta); (3) early visualization of the venous channels, because of newly formed (quasi-embryonal) arterio-venous communications; (4) displacement of "normal" arteries by the tumor mass.

Eleven illustrative cases are included, 8 of which were benign, the others malignant.

Thirty-four roentgenograms.

E. R. N. GRIGG, M.D.  
Cook County Hospital, Chicago

**Intravenous Placentography.** Robert C. Goodlin, Richard Greenspan, and Eugene F. Bernstein. *Surg., Gynec. & Obst.* 111: 240-242, August 1960. (University Hospitals, Minneapolis 14, Minn.)

The roentgenographic demonstration of the placental site in patients with suspected placenta praevia is difficult and frequently inaccurate when performed by conventional methods. The authors describe a technic for intravenous placentography which is based on the fact that one-eighth of the cardiac output in the pregnant woman is diverted to the placenta.

A large bore needle or a polyethylene catheter is inserted into the antecubital vein and 75 c.c. of 85 or 90 per cent Cardiografin or Hypaque is injected rapidly (within three seconds). Seven seconds after the completion of the injection a single anteroposterior film of the abdomen is taken. Shortly thereafter, a second film is taken for purposes of comparison.

Twenty-five patients have been examined by this method. In 16 visualization of the placenta was good; in 6 only fair, but sufficient to rule out the presence of a low implantation. In 3 patients visualization was poor, and the placenta could not be localized. There were no false localizations and the correlation between the placental site, as demonstrated by the placentogram, and the site determined at the time of delivery was 100 per cent.

The advantage of this method is that it enables one to make a direct diagnosis as to the location of the placenta. In comparison with soft-tissue placentog-

raphy, there is a decrease in irradiation exposure, since only two films are required. No serious complications have been encountered.

[The authors do not state at what time during pregnancy the examination is best performed.—W. L. E.]

Five roentgenograms. WALTER L. EATON, M.D.  
University of Pennsylvania

**Radiographic Demonstration of Gartner's Ducts.** W. J. Weston. *Brit. J. Radiol.* 33: 371-373, June 1960. (Hutt Hospital, Lower Hutt, N. Z.)

In a small percentage of cases vestigial remnants of Gartner's duct (Wolfian duct or mesonephric duct) can be outlined at hysterosalpingography. A case is reported in which the ducts on both sides were opacified. This is believed to be the first time that both ducts have been demonstrated in the same patient. On the right side the whole length of the duct persisted from the region of the broad ligament to the level of the lower vagina; the typical shape and position identified it with certainty.

The opaque medium probably entered the ducts at the level of the internal os of the cervix. This is the site where histologic examination has shown the branches of the duct to arise.

The embryology of Gartner's duct is reviewed.

Two roentgenograms; 1 diagram.

RICHARD P. STORRS, M.D.  
Los Angeles, Calif.

**Roentgen Investigation of Pregnancy with Triplets, Including a Twin Thoracopagus.** G. Agati and D. Prigione. *Ann. radiol. diag.* 32: 271-284, 1959. (In Italian) (Istituto di Radiologia dell'Università di Torino, Italy)

A roentgenogram of a primipara in the eighth month of pregnancy, obtained in 1957, showed three fetal skeletons, all in head-down position, but two of them in a peculiar symmetrical arrangement, both with "deflexion" of the spine. The first born was a healthy boy, well and alive at the time of this report. The still-born "twin" proved to be a female thoracopagus, which explained the unusual appearance of the maternal roentgenogram. Postmortem angiography of the thoracopagus demonstrated that only one of the twins had a heart, and that they shared a single liver.

When critical decisions have to be made during childbirth, it may be of importance to know ahead of time what, if any, fetal malformations are present. Careful scrutiny of prenatal roentgenograms can often yield such information.

Five roentgenograms; 3 photographs.

E. R. N. GRIGG, M.D.  
Cook County Hospital, Chicago

## THE GENITOURINARY SYSTEM

**The Concentration of Pyelographic Contrast Media. A Radiographic Method of Estimation of Renal Function.** R. H. Owen. *Brit. J. Radiol.* 33: 368-370, June 1960. (Royal Gwent Hospital, Newport, England)

In intravenous pyelography the concentration of contrast substance in the urinary tract varies considerably from patient to patient, depending on the concentrating power of the kidneys and on dilution of the medium by diuresis. The intravenous pyelogram is used as a guide to renal function, but the relative importance of these two factors is often difficult to judge. For a more

accurate functional study, a method was devised for measuring the percentage concentration of the contrast medium in the urine after pyelography.

The patient is instructed to empty the bladder, and a pyelographic examination is then carried out. Forty minutes after the injection of the contrast medium, the patient voids again and the volume of urine is measured. A portion of the urine is then placed in one cell of a six-cell plastic container. One of the other cells contains water and the others 1, 2, 3, and 4 per cent solutions of the contrast material. The container is then radiographed, and the film is developed in the usual manner. The concentration of opaque medium in the urine sample can then be easily determined by matching with the density of the standards. A simple calculation gives the weight of the medium excreted, in grams. This figure is then expressed as a percentage of the weight of the medium injected.

The average amount of contrast medium excreted at forty minutes in a "normal" or control series was 54 per cent of the dose injected. Two patients had low excretion rates accompanied by diuresis, although no abnormality was detected clinically or urographically. In 11 cases with abnormalities of the renal tract, excretion was found to vary from none at all to 48 per cent at forty minutes.

Seven roentgenograms; 1 photograph; 2 tables.

RICHARD P. STORRS, M.D.  
Los Angeles, Calif.

**Retrograde Ileopyelography.** Charles J. Staley, Surg., Gynec. & Obst. 111: 243-244, August 1960. (VA Research Hospital, Chicago, Ill.)

Retrograde ileopyelography was carried out in 25 patients in whom a urinary diversion operation had been performed, with the ureters anastomosed to an isolated segment of small bowel and intestinal continuity re-established. The contrast medium was injected into the "ileal bladder," using either a partially inflated Foley catheter or a soft rubber nipple to obliterate the stoma. Films obtained with this technic were compared to excretory pyelograms in each instance. In 22 patients it was possible to visualize roentgenologically the isolated ileal segment, ureteroileal junction, ureters, renal pelvis, and calyces. In the remaining 3, ureteral reflux was not demonstrated; in 1 of these lack of reflux was found to be due to ureteral compression from a neoplasm. It is thought that ureteral reflux might have occurred in the other 2 patients if greater injection pressure had been employed. The fact that lack of reflux is not absolutely indicative of ureteral or ureteroileal obstruction must be recognized in evaluating the individual case.

Several patients had one nonfunctioning kidney preoperatively as judged by intravenous pyelography. In such cases, renal function is frequently restored after urinary diversion if obstruction has not persisted beyond the point of no return. In the postoperative evaluation of these cases, it is reassuring to find that persistent nonfunction is due to renal insufficiency rather than to ureteral or ureteroileal obstruction. Retrograde ileopyelography is not recommended as a routine procedure, but it may provide important information in the study of an occasional patient with an ileal bladder. No complications as a result of the examination were encountered in the present series.

Two roentgenograms. ROBERT BEAROR, M.D.  
University of Pennsylvania

**Tolerance of the Kidneys to the Contrast Medium Urografin.** F. G. Smiddy and G. K. Anderson. Brit. J. Urol. 32: 156-159, June 1960. (University of Leeds, Leeds, England)

Among 86 patients suffering from acute reversible renal failure at the General Infirmary at Leeds, 3 had undergone aortography immediately prior to the development of anuria and this was believed to be the precipitating cause. Death occurred in 1 case. In 2 examinations Urokon 70 per cent had been employed; in the third the medium was not known.

To determine whether or not Urografin 70 per cent for abdominal aortography was toxic to renal tissue, a study was carried out in 21 white albino rabbits. Injections of 0.5 ml. were made into the left renal vessel. Circulation to the right kidney remained uninterrupted and it served as a control. The animals were divided into three groups of 7 each. In Group A, the interval between injection and removal of the kidney was one hour; in Group B, seventy-two hours; in Group C, seven days.

In all of the injected kidneys there was naked-eye evidence of transient vascular disturbance. In none of the animals killed within one hour of injection was any histologic change found in the kidneys after careful search of many areas. In Groups B and C, however, some scanty, scattered microscopic lesions were noted in the left kidneys. These were restricted to isolated tubules and were unaccompanied by any general reaction. They were thought to be small foci of recently deposited calcium phosphate, probably representing the dystrophic calcification of renal tubular epithelium which had sustained mild damage either as a result of vascular disturbances occasioned by the injection of the contrast medium or from slight inherent toxicity of the medium itself. In the authors' opinion, however, they were too small and scattered to be of clinical importance.

Three photomicrographs.

**A Report of a Case of the Injection of a Massive Dose of Urografin into the Renal Artery.** W. M. L. Laubscher and F. P. Raper. Brit. J. Urol. 32: 160-164, June 1960. (United Leeds Hospitals, Leeds, England)

The unexpected injection of a large dose of Urografin into one of two arteries supplying a kidney provided an opportunity to study the effects of such an injection on the renal parenchyma and to make a comparison with the uninjected portion of the same kidney.

A 46-year-old male laborer was admitted to the hospital with left renal colic of six hours duration. Intravenous pyelographic findings suggested a severe left ureteral obstruction but gave no indication of its site or nature. The appearance on a retrograde pyelogram led to consideration of a possible tumor in the lower pole of the kidney. Aortography was then performed. A catheter was passed via the right femoral artery into the aorta. Thirty milliliters of 76 per cent Urografin was injected but the automatic cassette changer broke down and no films were exposed. Another injection of 25 ml. of the medium was made without moving the catheter and films were exposed at thirty-second intervals. When the roentgenograms were examined, it was found that the tip of the catheter did not lie in the aorta but in a large left renal artery which supplied the major part of the kidney. The lower pole of the kidney was occupied by a vascular tumor, a finding confirmed forty-eight hours later at nephrectomy. Histologic exam-

imation showed the tumor to be a clear-cell carcinoma of poor differentiation. Multiple sections of normal kidney were also examined; there was no significant abnormality of the portion into which the medium had been injected.

Three roentgenograms; 1 photomicrograph; 1 photograph.

### MISCELLANEOUS

**Roentgenographic Manifestations of Diabetes Mellitus.** Martin W. Donner and John G. McAfee. *Am. J. M. Sc.* 239: 622-641, May 1960. (The Johns Hopkins University School of Medicine, Baltimore, Md.)

This is an excellent description of the many complications which may occur in diabetes mellitus, their detection, and evaluation by roentgen examination. Only a

few of the many findings described are characteristic, such as calcification of the vas deferens and cystitis emphysematosa. Of particular importance is the use of films of the lower extremities and of arteriography in the evaluation of vascular insufficiency and in the detection of osteomyelitis. Urography is a most important adjunct in the study of diabetic urinary tract infections. A summary, in table form, is given of the more important radiological manifestations which are caused by infection, degeneration, and neuropathy, and these are listed according to their effect on various structures. The radiologic changes attributable to infection alone are numerous.

A bibliography of 187 references is appended.

Twenty-one roentgenograms; 1 table.

WYNTON H. CARROLL, M.D.  
Shreveport, La.

### RADIOTHERAPY

**Measurement of the Value of Treatment in Malignant Disease.** Robert McWhirter. *Clin. Radiol. (J. Fac. Radiologists)* 11: 144-149, July 1960. (University of Edinburgh, Edinburgh, Scotland)

An urgent plea is made by the author for the use of more reliable measurements of the values of different cancer treatment methods. In particular the following questions should be answered: Do treated patients have a greater life expectancy than the untreated? How should the value of treatment in any site be measured? How should the value of different treatment methods be compared?

The actuarial method of analysis is probably the only reliable means of telling whether any procedure prolongs life expectancy.

The true value of cancer therapy in any anatomic site can be determined only if the total cases occurring in a geographical region are analyzed. A sample of cases will not suffice, nor will an analysis based solely on the method suitable for early cases. The study must embrace the treatment policy as a whole.

To compare two methods, a well defined sample is needed, with all patients suitable for management by either procedure. The choice of treatment for any one patient should then be determined by some random method. It is pointed out that, as a rule, survival rates are based upon too small a proportion of total cases, so variably selected and so ill defined a sample, that they are unsuitable for comparison.

The suggestion is made that an auditing body be established to which an author could submit any survival rates he might propose to publish. This body could draft standard methods of presenting results and could judge whether an author's conclusions were valid prior to publication.

Eight tables. DON E. MATTHIESSEN, M.D.  
Phoenix, Ariz.

**Statistical Problems Which Arise in Cancer Therapy.** J. W. Boag. *Clin. Radiol. (J. Fac. Radiologists)* 11: 150-155, July 1960. (Mount Vernon Hospital, Northwood, England)

Statistics can never prove anything, but only indicate varying degrees of probability.

In comparing two treatment methods, the first question to be answered is: "How many patients have to be treated before a significant answer can be expected?"

The author shows that the size of the necessary treatment group falls rapidly as the magnitude of the treatment difference increases. A table is presented indicating the number of cases necessary to obtain a statistically significant result in a clinical comparison of two treatments.

Another question is: "How long will the experiment last?" This depends either upon the number of patients required and their rate of intake into the treatment series, or it may be on the length of follow-up time required.

When a major change in treatment is to be tested, the "randomized" clinical experiment carried out by a single clinician is probably not ideal; the clinicians as well as the patients ought to be "randomized." Since this is impractical, a method is presented for planning clinical trials. The technic includes "pairing" individual patients in treatment and control groups in several treatment centers, with each measuring its own results against the average of the others.

Seven figures. DON E. MATTHIESSEN, M.D.  
Phoenix, Ariz.

**Craniobuccal Origin, Signs, and Treatment of Craniopharyngiomas.** James B. Campbell and Frank M. Hudson. *Surg., Gynec. & Obst.* 111: 183-191, August 1960. (Columbia-Presbyterian Medical Center, New York 32, N. Y.)

A discussion of craniopharyngiomas is based on a series of 73 histologically verified tumors of craniobuccal origin. The majority of the tumors were cystic for the greater part of their volume; in 12 instances, however, a solid mass was present. Some cysts were multiloculated, but most frequently one predominated. Some cavity linings were flat, but usually there were villous folds with some degree of papillary projection. In respect to color and viscosity, the cyst fluid has been likened to machine oil. Where the tumor made contact with neural tissue, an adherent glial barrier was thrown up which usually precluded surgical resection without jeopardy to the brain and its vascular supply.

The predominant cytoarchitecture of the cyst linings was adamantinomatous. Where squamous epithelium was found, there was almost invariably some adamantinomatous tissue nearby. A pure squamous epithelial lining was rare. Interstitial deposition of calcium was

a constant microscopic finding. In 47 patients, the process was sufficiently extensive to be identifiable roentgenographically, a matter of diagnostic significance. In one or two specimens there was actual bone formation.

Craniopharyngiomas originate on the anterior superior surface of the pituitary gland or at or near the level of the sellar diaphragm. Once this structure is eroded, growth may take any direction; therefore, the signs and symptoms are not consistent nor is the order in which they appear. Some symptoms are manifestations of generalized increased intracranial pressure which follows occlusion of the foramina of Monro by an upward extension of the tumor. Others are doubtless caused by direct compression of a contiguous structure. Still others arise because of venous congestion in relatively remote tracts and nuclei secondary to compression of the basilar veins. The pituitary gland and hypothalamus are often affected early, with disturbances in water metabolism, low blood pressure, depressed basal metabolic rate, adiposogenital syndrome, dwarfism, cachexia, polyphagia, and decreased libido or impotence.

Anterior and anterolateral extensions of the tumor were responsible for the majority of visual symptoms (68 patients) and signs (59 patients). The Foster Kennedy syndrome was seen only 3 times, whereas bilateral papilledema with bilateral optic atrophy was more common. Morbid drowsiness was seen in 46 cases, stupor in 12, irritability in 8, and coma in 4. Vomiting occurred in 36 patients, pyramidal tract signs in 33, papilledema in 30, cerebellar signs in 14, and weakness in 30. A mimetic facial paresis was found in 24 persons and anosmia in 14.

Fifty-two per cent of the patients in the series showed some roentgen evidence of increased intracranial pressure. Erosion of the sella turcica was detected in 22 patients. As mentioned before, radiopaque flecks or small plaques of calcium deposition within the lesion were apparent in 47 roentgenographic studies. Ten of 12 patients with sella turcica enlargement without erosion exhibited intrasellar as well as extrasellar calcification. The amount of the calcification was not related to the size of the lesion.

The ideal treatment for all neoplasms is total removal, and this would apply in particular to the craniopharyngioma which is a benign lesion. Each surgical attack must be planned in accordance with the clinical signs and roentgenographic data obtained from plain films and ventriculograms. The usual operative approaches employed were subfrontal or transventricular. Seventy-one of the patients in the series were operated upon. The surgical mortality was 29 per cent.

Twenty-five patients received postoperative roentgen therapy. A graph of percentage survival as a function of time does not show convincing evidence in favor of the addition of irradiation. It is possible that locally instilled sources of beta particles ( $P^{32}$ ,  $Au^{198}$ , and  $Y^{90}$ ) will have more to offer than roentgen therapy, when it is not possible to extirpate the tumor completely. In general, persons with solid tumors and minimal cyst formation did poorly as compared to those whose signs developed in conjunction with expansion of a cyst that was resectable or accessible for evacuation or open drainage into the ventricular system.

Seven figures, including 1 roentgenogram.

MARK M. MISHKIN, M.D.  
University of Pennsylvania

**Nasopharyngeal Fibroma: Its Malignant Potentialities and Radiation Therapy.** G. E. Massoud and H. K. Awwad. *Clin. Radiol. (J. Fac. Radiologists)* 11: 156-161, July 1960. (Alexandria University, U.A.R., Egypt)

Seven cases of nasopharyngeal fibroma are reviewed, with special attention to the invasive and malignant properties of the tumor and to its response to radiation therapy.

The 7 cases were all in males, from twelve to twenty-five years of age. All showed forward extension into one or both nasal fossae; atrophy or destruction of the nasal septum and lateral nasal boundaries was also observed. In 1 patient the sella turcica was enlarged, with destruction of its floor. The antrum was involved in 5 cases, the orbit in 2, and the petrous apices in 2.

The first patient received a dose of 1,500 r, and the remainder 3,500 r to 4,000 r in four to five weeks (1.5 mm. copper h.v.l.). Three patients remained symptom-free with no detectable tumor at six, three, and one and a half years after treatment respectively. One local recurrence developed two years after treatment with 3,500 r in four weeks. The recurrent tumor was given 3,000 r, also in four weeks, but after another year further recurrence developed in the deep cervical tissues, and still later in the lumbar vertebrae. In 2 cases with partial regression after treatment, the residual masses were excised and the patients remained symptom-free three and a half years after surgery. One patient was lost to follow-up.

Although the literature does not emphasize the malignant potential of these tumors, the present series suggests a malignant tendency by a high incidence of bone destruction and occurrence of extensive metastases in cervical nodes and lumbar vertebrae.

The complete regression of tumor masses in 4 of the patients indicates that radiation therapy may play a useful role for primary treatment and for palliation.

Seven roentgenograms; 3 photomicrographs; 3 tables.

DON E. MATTHIESSEN, M.D.  
Phoenix, Ariz.

**Irradiation and Surgery in the Treatment of Bronchogenic Carcinoma.** Fernando G. Bloedorn and R. Adams Cowley. *Surg., Gynec. & Obst.* 111: 141-146, August 1960. (University of Maryland Hospital, Baltimore, Md.)

More than three years ago the authors decided to explore the action of cobalt teletherapy in bronchogenic carcinoma and in particular the possibilities of an approach combining cobalt therapy and surgery. They report their experience with 52 patients. Twenty-six of these (Group 1) were under the direct control of the Division of Radiotherapy and the Division of Thoracic Surgery at the University of Maryland Hospital, and combined therapy was planned as soon as the diagnosis was established. Eight patients (Group 2) without previous irradiation were operated upon in other hospitals and were treated by the authors postoperatively with irradiation. Eighteen patients (Group 3) were referred from other hospitals and by private physicians and received cobalt teletherapy alone.

The combined treatment procedure consisted of cobalt-60 teletherapy before operation, with 5,500 to 6,000 r being delivered in five weeks to the primary tumor and its probable contiguous extension (the minimal area treated was the primary tumor and the whole mediastinum), followed in two months by surgical re-

Potential, and H. K. R., Egypt) are responsive and its response to twenty. Invasion into of the lungs is also enlarged, was in the apices

and the weeks (1.5 and symptoms and one. One treatment nor was her year critical tis. In 2 the resid. remained surgery.

he maf.ies sug. of bone mases in

of the play a. n. us; 3 I.D. ariz.

chono- d R. -146, pital,

ed to genic in ap. They y-six of the tracic and and nosis out hospital. were vians

co-000 nor nial ole re-

removal of the lesion. Three different irradiation techniques were used, depending upon the histologic type and location of the tumor—well-differentiated squamous-cell carcinomas and adenocarcinomas, anaplastic tumors or undifferentiated squamous or adenocarcinomas, and primary tumors in the apices of the lung. In general, the treatment was well tolerated. The two-month waiting period prior to surgery is considered indispensable; it permits the full effect of irradiation to be achieved and it allows sufficient time for the acute radiation reaction to subside. In most cases a pneumonectomy was performed through a posterolateral thoracotomy incision. Adhesions were usually minimal except in those patients in whom thoracotomy had been performed previously for biopsy purposes.

Of the 26 patients in Group 1, 18 received the complete combined treatment; the remaining 8 patients received irradiation but surgery was not performed, either because it was refused or because distant metastases developed. All tumors were operable and resectable after cobalt teletherapy (8 of the 18 had been considered inoperable before irradiation). Of the 18 patients who had the complete combined treatment, 13 were alive and free of disease at the time of the report, with the longest survival forty-four months.

The patients in Group 2, who had postoperative cobalt teletherapy, all had operable, clinically early lesions; 7 had metastases to the mediastinal nodes. Five of these patients died, 4 within four months of the beginning of treatment. Three patients were alive and well, with the longest survival twenty-seven months.

Of the 18 patients in Group 3, who had only cobalt teletherapy, 11 had tumors which were found to be inoperable. Fourteen of the patients died. Four were alive two to six months after therapy, 2 with active disease.

A comparison of the results among these three groups is not possible because of the small number of cases and the disparity of the material. The patients who underwent postoperative irradiation all had mediastinal nodes. Those treated by irradiation alone had more advanced disease. The patients considered for combined cobalt-60 therapy and surgery were not early cases, however, since 50 per cent of these were believed inoperable.

The authors point out the following interesting facts:

1. There is a high resectability rate after cobalt therapy.
2. The incidence of mediastinal lymph-node metastasis after irradiation is low.
3. The incidence of distant metastases was lower than anticipated in the cases in which combined therapy was employed.
4. Complications imputable to the combined procedures failed to materialize.

## RADIOISOTOPES

**The Use of Radioactive Iodine Labeled Triolein in the Evaluation of Fat Absorption Following Cholecystectomy.** E. J. Fedor and Bernard Fisher. *Surg., Gynec. & Obst.* 111: 206-210, August 1960. (University of Pittsburgh School of Medicine, Pittsburgh, Penna.)

The validity of the impression that postcholecystectomy patients have an altered fat metabolism was investigated by the authors with the use of  $I^{131}$ -labeled triolein. Fat absorption was measured in 131 males

This form of therapy has suggested the possibility of sterilizing mediastinal lymph-node metastases by means of cobalt irradiation. The need for postirradiation surgical removal of the site of the primary tumor is ever present because there is always the possibility of failure in its control. Of the 44 patients treated by cobalt alone, and cobalt plus surgery, 24 had active disease at the site of the primary tumor.

The authors believe that the evidence so far accumulated justifies pursuing this study.

EUGENE F. FOLEY, JR., M.D.  
University of Pennsylvania

**Treatment of Carcinoma of the Cervix with Radium and Telecobalt.** G. Ambesi Impiombato, M. Chelazzi, and R. Milanesi. *Radiol. med.*, Milan 45: 1095-1113, November 1959. (In Italian) (Istituto Regina Elena per lo Studio e la Cura dei Tumori, Rome, Italy)

The authors describe the procedure used in their institution for the treatment of carcinoma of the cervix. It employs a radium applicator devised by Dr. Jerace (a member of their staff), consisting of three metallic tubes, each of which carries a capsule for the insertion of radium. The capsule for the central tube is of cylindrical shape, to fit the uterine os. The capsules for the lateral tubes are rounded, being intended for the uterine fornices: these rounded capsules are attached to movable joints, which allow "spreading" for adjustment to the size of the uterine fundus. The two lateral tubes can be fastened to, or separated from, the central tube by a simple metallic connecting piece.

Patients with carcinoma of the cervix, as long as the uterine os is patent, are first given radium therapy. With the above applicator, the dose to point A is 8,000 r, while point B receives at least 2,400 r but not more than 3,200 r. Radium therapy is supplemented with telecobalt irradiation through four fixed ports, bringing the total dose to 6,000 r at point B (i.e., at least 2,800, but not more than 3,600 r). To do the same job with a conventional roentgen apparatus (50 cm. focal distance, 1.0 mm. Cu h.v.), the skin dose might have to be raised to between 5,350 and 7,000 r, which would lead to permanent damage in a large number of instances.

In those patients in whom the uterine os is not patent, telecobalt therapy, about 3,000 r, is given to the mid-pelvis. If the os opens up, the radium applicator is inserted, after which external telecobalt irradiation is again added, to bring the dose to point B to a total of 6,000 r.

An alternative procedure, also employed for palliation, is to treat the uterovaginal axis with telecobalt (either through fixed ports or some rotatory arrangement) with 5,000 to 6,000 r.

Twelve roentgenograms; 4 photographs; 8 drawings; 5 tables.

E. R. N. GRIGG, M.D.  
Cook County Hospital, Chicago

and females between sixteen and seventy-seven years old. Group I, the control group, comprised 28 normal persons. Twenty-seven patients (Group II) had undergone surgery that did not involve the biliary or gastrointestinal tract seven days prior to study. Twenty-two (Group III) had been similarly subjected to a variety of surgical procedures one hundred to five hundred days prior to testing. The 32 patients in Group IV and the 21 in Group V had undergone cholecystectomy without

exploration of the common duct seven and one hundred to five hundred days, respectively, before the present study.

Twelve and sixteen hours prior to testing, each person was given orally 20 drops of Lugol's solution to saturate the thyroid. After a twelve-hour fast, he was given a capsule containing 50 microcuries of  $I^{131}$ -labeled triolein and a fatty meal. One-half of the members of each group drank an emulsion of olive oil (0.5 milliliter per kg. body weight), milk, 20 drops of Lugol's solution, and 20 milliliters of Oily Dionosil to opacify the test meal. The other half received an identical meal except that it contained more olive oil—1 milliliter per kilogram of body weight. The progress of the meal was determined roentgenographically four hours after its ingestion. Blood samples were drawn at two-, four-, six-, and eight-hour intervals after administration of the emulsion, and the radioactivity was measured with a scintillation counter. Fecal samples were collected for seventy-two hours, and counts were performed for sufficient time to give statistical accuracy to the data.

The results revealed no significant difference in fat absorption among the five groups, even when the larger amount of fat was given. After the large fatty meal, however, a delay in gastric emptying occurred in all groups but, as shown by the low seventy-two-hour fecal isotope content, no impairment of absorption resulted.

Blood radioactivity levels and seventy-two-hour fecal isotope content determinations revealed that the rate of fat digestion and absorption between young and aged individuals and between males and females was not significantly different.

Not a single patient in this study, including those who had cholecystectomy seven days prior to testing, complained of discomfort after ingestion of either test meal. The authors conclude that the discomfort that follows cholecystectomy—the postcholecystectomy syndrome—is not related to faulty fat absorption. Other etiologic factors must be considered.

Four figures. ROBERT E. CAMPBELL, M.D.  
University of Pennsylvania

**Effect of Diuretics Upon the Serum Protein Bound Iodine and the Thyroidal Uptake of Radioactive Iodine.** David E. Schteingart, Martin Perlmutter, and Marvin Numeroff. *Am. J. M. Sc.* 239: 571-577, May 1960. (M. P., Maimonides Hospital, Brooklyn, N. Y.)

The significance of low serum protein-bound iodine (PBT) determinations in patients who have received mercurial injections has been questioned. Since diuretics do cause increased excretion of chlorides, studies were made to determine if they also increase ioduresis and perhaps thus result in a lower thyroidal accumulation of  $I^{131}$ .

Serum PBI levels, twenty-four-hour thyroidal uptake, and twenty-four-hour urinary excretion of  $I^{131}$  were studied in a group of patients who had been given mercurial diuretics, such as meralluride, chlorothiazide, and acetazolamide. Some of the patients were in congestive heart failure with secondary fluid retention. Serum PBI, determined by Barker's dry-ashing technic, was not changed significantly by any one of the three diuretic agents. Nor was there any effect upon ioduresis and the twenty-four-hour thyroidal uptake of  $I^{131}$  in either normal subjects or patients with congestive heart failure.

WYNTON H. CARROLL, M.D.  
Shreveport, La.

**Radioactive Iron Studies in Patients with Iron Deficiency Anemia with Concurrent Abnormal Hemolysis.** M. C. Verloop, M. Van der Wolk, and A. J. Heier. *Blood* 15: 791-806, May 1960. (Geneeskundige Universiteitskliniek, Utrecht, Netherlands)

Patients are occasionally encountered with hypochromic anemia and signs of iron deficiency who show suboptimal response to iron administration. Two cases are reported here of severe iron-deficiency anemia concomitant with abnormal hemolysis. The life span of the patients' red cells was shortened as demonstrated by autotransfusion of  $Cr^{61}$  labeled erythrocytes and determination of red blood cell survival time. Transfused normal red cells were more rapidly broken down. Extra-corporeal factors seem to be responsible for the pathologic hemolysis. There was no pathologic sequestration of red cells in the spleen. After incorporation of radioactive iron into the red cells, the utilization percentage of  $Fe^{59}$  under iron therapy fell to about 15 per cent within a few weeks. The iron was apparently not sufficiently re-utilized.

Six other patients with less severe iron-deficiency anemia and an insufficient response to iron therapy were examined. In 5 of these patients, the life span of red cells labeled with  $Cr^{61}$  was shorter than normal.

An insufficient response to iron therapy in patients with chronic iron-deficiency anemia may be ascribable, in some instances, to concomitant pathologic hemolysis.

Two photomicrographs; 9 graphs; 3 tables.

WYNTON H. CARROLL, M.D.  
Shreveport, La.

**Effect of Corticosteroids and Gluten-Free Diet on Absorption of Iron in Idiopathic Steatorrhea and Celiac Disease.** John Badenoch and Sheila T. Callender. *Lancet* 1: 192-194, Jan. 23, 1960. (Nuffield Department of Clinical Medicine, Radcliffe Infirmary, Oxford, England)

There is gross malabsorption of iron in patients with idiopathic steatorrhea and celiac disease. With  $Fe^{59}$  as the tracer, measurements were made of the effect of treatment with corticosteroids and gluten-free diet on iron absorption in 10 patients with idiopathic steatorrhea and celiac disease and in 12 controls. Five milligrams of iron labeled with 4 to 5  $\mu$  of  $Fe^{59}$  was given orally to each person, as a solution of ferrous sulfate to which 25 mg. of ascorbic acid had been added to insure that the iron remained in a reduced form. The dose was administered during a fast; nothing was given by mouth for a further two hours. The maximum radioactivity subsequently appearing in the blood was used as a measure of the absorption of iron, although in a few instances the unabsorbed radioactive iron in the feces was also determined. With the exception of 1 patient who had been taking cortisone in a dose of 20 to 100 mg. daily for twelve months prior to the test, steroids were administered to both patients and controls, either in the form of 40 mg. of prednisone daily for five or six days before and one or two days after the dose of iron was given, or as 40 units of corticotrophin intramuscularly daily for three or four days prior to the test. The effect of the gluten-free diet was assessed after its administration for six weeks to a year.

In the 12 controls there was no constant alteration in the amount of labeled iron which appeared in the red cells. The absorption of iron (less than 8 per cent, mean 3.6 per cent) in all the patients with steatorrhea increased after administration of prednisone or cortisone

with Iron  
and A. J.  
Genneskun-  
d)

with hypo-  
who show  
Two cases  
emia con-  
spite span of  
demonstrated  
erytes and  
Trans-  
ken down.  
sible for  
pathologic  
ter incor-  
pity fell to  
iron was

efficiency  
apy were  
n of red

patients  
scribable,  
molybdate.

M.D.  
t, La.

Diet on  
and Co-  
llender.  
Depart-  
y, Ox-

ts with  
Fe<sup>2+</sup>  
effect on  
diet on  
tearator-  
the milli-  
given  
fate to  
insure  
se was  
en by  
radioisot-  
es used  
in a  
in the  
of 1  
of 20  
test,  
con-  
ly for  
or the  
ophin  
o the  
ressed

in  
red  
cent,  
rheu-  
sone

to between 17.5 and 55 per cent (mean 27 per cent) except in 1 severe, long-standing case. In 1 instance the 37 per cent absorption of iron obtained after a year of treatment with cortisone dropped to 8 per cent after discontinuance of steroids for only one week, although the patient's general condition was excellent, without diarrhea. Corticotrophin was administered to 3 patients and improvement in absorption was noted in all, but the difference was not as clear as that following the oral steroids.

In celiac disease a gluten-free diet improved the absorption of iron.

Three figures.

**The Kinetics of Intravenously Injected Radioactive Vitamin B<sub>12</sub>: Studies on Normal Subjects and Patients with Chronic Myelocytic Leukemia and Pernicious Anemia.** Eugene A. Brody, Solomon Estren, and Louis R. Wasserman. *Blood* 15: 646-661, May 1960. (The Mount Sinai Hospital, New York, N.Y.)

The action of intrinsic factor in effecting absorption of vitamin B<sub>12</sub> is known to occur within the gastrointestinal tract, but the fate of intrinsic factor after it has effected this transfer is not known. Further, the precise mechanisms responsible for transfer of the vitamin across the intestinal wall into plasma, and from plasma to the tissues, are also unknown.

The authors undertook to examine the clearance of B<sub>12</sub> from the plasma and to determine some of the factors and diseases which modify transfer to the tissues. They injected vitamin B<sub>12</sub> labeled with cobalt 58 or cobalt 60 intravenously in patients with normal, low, and high serum concentrations of vitamin B<sub>12</sub>. Abnormal plasma disappearance curves were noted in chronic myelocytic leukemia, pernicious anemia, and in relapse and in remission, total gastrectomy, and malabsorption syndrome. In chronic myelocytic leukemia,

the slow clearance of plasma radioactivity may be explained by the increased binding capacity of the plasma proteins for the vitamin. Plasma clearance of radioactivity is slower than normal in pernicious anemia, even in remission. The failure of the disappearance curve to return to normal in pernicious anemia in complete remission suggests the existence of a plasma "B<sub>12</sub>-transferase" whose function it is to transfer circulating B<sub>12</sub> to the tissues. The disappearance curves obtained in these studies seem to indicate that the amount of this factor is diminished in pernicious anemia, total gastrectomy, and certain cases of malabsorption syndrome.

Ten graphs; 2 tables.

WYNTON H. CARROLL, M.D.  
Shreveport, La.

**Strontium Studies in Beagles.** B. W. Glad, C. W. Mays, and W. Fisher. *Radiation Res.* 12: 672-681, June 1960. (University of Utah, Salt Lake City, Utah)

The metabolism of Sr<sup>85</sup> in beagles was investigated in relation to the following factors: (1) previous skeletal irradiation; (2) confinement after Sr<sup>85</sup> injection; (3) age at Sr<sup>85</sup> injection; (4) comparison with radium metabolism.

Previous skeletal irradiation from bone-deposited radionuclides does not seem to influence the metabolism of Sr<sup>85</sup> in beagles under the conditions, dose rates, and times studied.

Confinement immediately after the injection of a Sr<sup>85</sup> tracer dose reduces its retention.

As the age of the beagle increases from six months to ten years, the retention of a Sr<sup>85</sup> tracer decreases.

The fact that strontium retention in beagles is less than radium retention was verified.

Six figures; 2 tables.

## RADIATION EFFECTS; PROTECTION

**Thyroid Cancer After Irradiation in Adult Life.** A. M. Jelliffe and K. M. Jones. *Clin. Radiol. (J. Fac. Radiologists)* 11: 162-165, July 1960. (The Middlesex Hospital, London, W.1, England)

This article reviews the literature on thyroid cancer after irradiation in adult life and adds a new case.

The patient was treated with radium for keloid in burn scars on the neck at the age of twenty-four, receiving about 5,500 r (gamma) over four months. At the age of fifty-five the thyroid in the treated area was large and nodular. Three years later the diagnosis of thyroid adenocarcinoma was surgically proved, but not until after the lesion had destroyed the spinous process, pedicle, and lateral aspect of the body of the second dorsal vertebra.

A table is presented summarizing the 11 cases in the literature which are regarded as being probably real post-external irradiation thyroid cancers in adults. The average latent period was twenty-three years. In 5 cases, including the authors', skin changes due to irradiation were minimal or absent. In view of this observation and the long latent period, it appears likely that the association between thyroid cancer and irradiation may have been missed in the past.

The absence so far of any evidence of cancer production in adult man from radioiodine therapy may be establishing a false sense of security. The first attempts

at treating thyrotoxicosis with I<sup>131</sup> were made only eighteen years ago. If the usual time lapse is to be expected, radiation cancer following the use of radioiodine may be reported at any time from now on.

Experience reveals that I<sup>131</sup> can give rise to thyroid cancer in animals, especially when used in combination with antithyroid drugs. This suggests that the employment of thyroid derivatives to prevent production of hypothyroidism (and consequent excessive thyroid stimulation by TSH) might reduce, and perhaps prevent, the occurrence of post-irradiation cancer of the thyroid.

One roentgenogram; 1 photograph; 2 photomicrographs.

DON E. MATTHIESSEN, M.D.

Phoenix, Ariz.

**A Universal Gonadal Shield.** Enrique Schwarz, John I. Pretto, and Samuel Martin. *Illinois M. J.* 118: 24, July 1960. (College of Medicine, University of Illinois, Chicago, Ill.)

The authors report a modification of Abram's gonadal shield (Brit. J. Radiol. 31: 335, 1958), which has been tested and used successfully for both men and women of all ages. The shield consists of leaves of lead, each 6 x 1 inch, put together like a fan so that it may be easily adjusted to patients of various size.

Two roentgenograms; 3 drawings.

**Acute Effects of Gamma Radiation in Primates.** Ralph G. Allen, Frank A. Brown, Loren C. Logie, David R. Rovner, Stephen G. Wilson, Jr., and Robert W. Zellmer. *Radiation Res.* 12: 532-559, May 1960. (School of Aviation Medicine, USAF, Randolph AFB, Texas)

A study was made of the survival of small primates (*Macaca mulatta*) after whole-body exposure to a source of pure  $\gamma$ -radiation to examine the extent and location of dose-independent regions, to observe the clinical and pathological syndrome produced by irradiation, particularly in the less well understood mid- and high-dose regions, and to determine the LD 50/30 dose.

One hundred and seven animals were exposed in 16 groups to rapid delivery of  $\text{Co}^{60}$   $\gamma$ -rays at doses of 400 to 40,000 r. Statistical evaluation of survival times, determination of the LD 50/30 dose, clinical observations for a 30-day post-irradiation period, and immediate postmortem examinations were performed. The three approaches to this experiment, namely, statistical evaluation of survival time, clinical observations, and pathological evaluation, led to similar conclusions with regard to mechanisms of radiation death associated with three dose ranges. In the high-dose groups (9,000 to 40,000 r), the predominant clinical pattern was one of severe and progressive dysfunction of the central nervous system. In contrast, those animals comprising the intermediate-dose groups (1,000 to 10,000 r) were distinguished by a linear log survival-log dose relationship, which is less dose-dependent. This, too, was associated with characteristic clinical signs and pathological changes. Although anorexia and diarrhea are not necessarily specific manifestations of radiation injury, the pathologic changes can be considered highly specific for radiation-induced pathology. In the lower-dose groups of 400 to 1,000 r, marked variations in the clinical syndrome and pathologic findings were observed, but the common denominator was universal failure of the bone marrow. By far the greatest number of deaths could be attributed to bacteremia and localized destruction of tissue by bacteria proliferating in the absence of host resistance. Occasionally, localized hemorrhages compromised vital functions and led to rapid demise.

The clinical and pathological studies undertaken in this experiment provide further elucidation of the central nervous system, gastrointestinal, and hematopoietic types of radiation death.

Seventeen figures; 3 tables.

**Biochemical Effects of Internal Irradiation.** Charles C. Irving and Jesse D. Perkinson, Jr. *Radiation Res.* 12: 597-606, June 1960. (Veterans Administration, Medical Teaching Group Hospital, Memphis 15, Tenn.)

Intraperitoneal doses of 5.0, 3.0, and 0.5  $\mu\text{c}$  of  $\text{P}^{32}$  per gram of body weight were found to significantly inhibit the oxygen consumption of rat liver slices. The liver slice oxygen consumption was depressed 23 per cent at twenty-four hours after injection of 5.0  $\mu\text{c}$  of  $\text{P}^{32}$  per gram and was depressed to a lesser extent at the lower doses of  $\text{P}^{32}$ .

The anaerobic glycolysis of rat liver slices was inhibited also after injection of 5.0  $\mu\text{c}$  of  $\text{P}^{32}$  per gram of body weight, the maximum inhibition of liver slice anaerobic glycolysis being 60 per cent at twenty-four hours after administration of the  $\text{P}^{32}$ . The inhibition of glycolysis was not due to a lack of intracellular substrate since liver glycogen was increased at twenty-four

hours after injection of 5.0  $\mu\text{c}$  of  $\text{P}^{32}$  per gram of body weight.

The same dose of  $\text{P}^{32}$ , 5.0  $\mu\text{c}/\text{gm}$ , which inhibited oxygen consumption and anaerobic glycolysis, had no effect on liver succinic dehydrogenase, cytochrome oxidase, fumarase, and phosphorylase activities. Pyruvate oxidation and pyruvate utilization were also normal in the livers of the irradiated animals.

Two figures; 3 tables.

**Radiation-Induced Conditioned Avoidance Behavior in Rats, Mice, and Cats.** D. J. Kimeldorf, J. Garcia, and D. O. Rubadeau. *Radiation Res.* 12: 710-718, June 1960. (U. S. Naval Radiological Defense Laboratory, San Francisco, Calif.)

Ionizing radiation can serve as an unconditioned stimulus to instigate a conditioned behavior in the rat; the conditioned behavior is an avoidance response toward discriminative stimuli previously associated with radiation exposure. The conditioned response to saccharin, which has been found to occur with exposure to small doses of x-rays,  $\gamma$ -rays, and fast neutrons, has been produced in hypophysectomized, adrenalectomized, or oophorectomized rats. The present experiments were undertaken to determine if avoidance behavior conditioned through radiation exposure is also demonstrable in the mouse and cat.

Association of a distinctive taste stimulus with exposure to x-rays resulted in a conditioned aversion toward the stimulus in rats, mice, and cats. This was manifested by a progressive reduction in the amount of flavored fluid consumed during a series of x-ray exposures and subsequently by the acquired value of the flavored fluid to act as a conditioned stimulus for aversion behavior in the absence of irradiation. Saccharin-flavored water was effective as a conditioned stimulus for rats and mice, and chocolate-flavored milk was effective for cats. Some implications of these observations in the study of behavior are discussed.

Three figures; 1 table.

**Some Factors Which Influence Radiation-Conditioned Behavior of Rats.** John Garcia and Donald J. Kimeldorf. *Radiation Res.* 12: 719-727, June 1960. (U. S. Naval Radiological Defense Laboratory, San Francisco, Calif.)

Localized x-ray exposure of the head, thorax, abdomen, or pelvis served as a motivating stimulus to condition a saccharin aversion in rats. The abdomen proved to be a region of special sensitivity, although the response was not so pronounced as that after total-body exposure for the same dose. Neither adrenalectomy nor hypophysectomy prevented the development of the conditioned saccharin aversion after total-body exposure. On the basis of these findings, it is suggested that sensations triggered by gastric dysfunction may represent the stimuli through which irradiation acts to condition behavior in animals.

Four figures.

AUTHORS' SUMMARY

**The Effects of Prenatal Radiation on Postnatal Development in Rats.** R. L. Murphree and H. B. Pace. *Radiation Res.* 12: 495-504, May 1960. (University of Tennessee-Atomic Energy Commission Agricultural Research Laboratory, Oak Ridge, Tenn.)

One hundred and twenty-four litters of rats were used in an investigation of the effects of parental irradiation ( $\text{Co}^{60}$ ) on postnatal viability, growth, and sexual de-

development. The neonatal death rate was significantly higher in litters exposed to 110 r on days 13 to 15 (27 per cent,  $P < 0.001$ ), on days 16 to 18 (13 per cent,  $P < 0.05$ ), 150 r on day 14 (98 per cent,  $P < 0.001$ ), and 220 r on days 12 to 16 (77 per cent,  $P < 0.001$ ) of gestation as compared to control litters (6 per cent). The majority of postnatal deaths occurred by the seventh day. The viability was not affected in litters exposed to 150 or 220 r on day 20. The average weaning weights of all the irradiated groups were lower than the weight of the control group.

When bred to normal males, no difference was found between control and prenatally irradiated females in (1) per cent of fertile females, (2) per cent of corpora lutea as represented by living fetuses, or (3) fetal deaths. Ovulation was approximately 20 per cent lower in the irradiated than in the control females.

Mature body and testes weights of irradiated males were significantly lower than for control males ( $P < 0.001$ ). The degree of retardation in testes weights was dependent on the level of irradiation and the stage of gestation at the time of irradiation.

Five tables.

#### AUTHORS' SUMMARY

**Hypothermia and Ischemia of the Bone Marrow as Protection Against Injury by Whole-Body X-Irradiation in Rats.** Edgar J. Martin. *Radiation Res.* 12: 705-709, June 1960. (7 Edmund Ave., Apt. 604, Toronto, Ont., Canada)

The experiments described here were designed to determine whether combined hypothermia and ischemia of the bone marrow of rats during whole-body x-irradiation protect the elements of the bone marrow which contribute to post-irradiation recovery.

Five series of rats were given whole-body irradiation (with 750, 738, 670, 658, or 640 r) while their hind legs were tied and immersed in ice water. Controls received the same treatment except that the tourniquet was released immediately after being tied and water at body temperature was used. For a period of twenty-one days after irradiation the animals were observed for length of survival and the development of irradiation sickness as manifested by weight loss and diarrhea.

The severity of the initial irradiation sickness in protected animals was the same as in the controls. When the protected animals differed from the controls and recovered, they did so only after the third to seventh day. The findings suggest that the elements of the bone marrow which were to participate later in the defense against otherwise fatal complications were protected by the combined hypothermia and ischemia.

One table.

**Survival of Total-Body X-Irradiated Mice after Delayed Infusions of Isologous Bone Marrow.** Isaac Djerassi, Robert Woodruff, and Sidney Farber. *Radiation Res.* 12: 505-509, May 1960. (Children's Medical Center, Boston, Mass.)

The authors found that mice of the Swiss Webster, AKR/Jax, DBA<sub>2</sub>, and ICR Swiss strains were protected from LD 100 total-body x-irradiation by single or multiple infusions of isologous bone marrow cell suspensions, given as late as four to seven days after exposure. Large quantities of nucleated bone marrow cells (8 to 10 million) were used for each infusion. Suggestive evidence for increased protective effects was observed in some experiments when repeated injections of bone marrow were administered. Under the conditions of

these experiments, however, repeated administration of bone marrow did not seem to be more effective than one single large dose when injection was started on the fourth or fifth day after irradiation. Lower protection usually observed in these instances may be due to trauma or infection occurring with multiple injections.

Protection with delayed infusion of bone-marrow material was noted in all four strains of mice studied; although the sensitivity of those strains to total-body x-irradiation varies, results were essentially uniform.

These experiments show that protection against lethal doses of x-irradiation can be produced late after exposure, if adequate doses of compatible bone-marrow cells are used. The supportive effects of the bone-marrow infusions against the hemorrhagic tendency and reduced resistance to infection during the time required for adequate repopulation of the host bone marrow deserve further investigation.

One graph; 1 table.

**Damage and Recovery of Mouse Testis after 1000 r Acute Localized X-Irradiation, with Reference to Restitution Cells, Sertoli Cell Increase, and Type A Spermatogonial Recovery.** Bernard R. Nebel and Carol J. Murphy. *Radiation Res.* 12: 626-641, June 1960. (Argonne National Laboratory, Lemont, Ill.)

In the present study of mouse spermatogenesis special emphasis is placed on the apparently original observation that a single localized dose of 1,000 r can cause a fairly persistent block of first meiotic metaphase, comparable to the action of colchicine, but more prolonged than that resulting from a single colchicine dose. Many restitution nuclei similar to those seen after colchicine treatment form between the first and the tenth day after x-irradiation, the maximum being observed at six days. These restituted cells often drift toward the basement membrane. In agreement with previous investigators the authors found an excess number of Sertoli cells in heavily damaged tubules. This excess is not explained by cell division as shown by autoradiography, nor by shrinkage of tubules, since the number is abnormally high even after correction for the shrinkage. A major part of this excess apparently corresponds to the number of restitution cells formed from the blocked first metaphases. The ultimate fate of these indifferent "Sertoli"-like cells is unknown. They were not observed entering a new spermatogenic cycle. Type A spermatogonia were observed between eight and ten days after 1,000 r with a frequency of 0.007 per tubule. After division, the resulting daughter cells distribute themselves along the basement membrane, soon forming a complete ring of dividing spermatogenic cells, observed at twenty days in recovering tubules. Stage "XII" was observed at five weeks showing development only through first metaphase spermatocytes.

Thirteen figures.

**DNA Synthesis in Irradiated Hair Follicles of the Mouse.** S. M. Cattaneo, H. Quastler, and F. G. Sherman. *Radiation Res.* 12: 587-593, May 1960. (Brookhaven National Laboratory, Upton, N. Y.)

Hair follicles in mice were induced to produce hair by plucking and were then x-irradiated with 200, 800, or 3,000 rads.

Desoxyribonucleic acid (DNA) synthesis in the proliferating matrix cells of the irradiated hair follicles was studied at times from immediately after to forty-eight

hours after irradiation by the method of labeling with tritiated thymidine and autoradiography.

Reduction of thymidine incorporation commenced immediately after irradiation and amounted to about 50 per cent within thirty minutes with the two higher doses, possibly also with 200 rads. This was an effect on cells in the process of synthesizing DNA at the time of irradiation. It was followed by a slow decline which may be of a complex nature.

Resumption of DNA synthesis occurred within twelve hours post-irradiation, even with the highest dose used, and considerably preceded resumption of mitotic activity.

Two figures.

AUTHORS' SUMMARY

**Reaction of Limb Regenerates of Adult Axolotl (*Sirens mexicanum*) to X-Irradiation.** V. V. Brunsch. *Radiation Res.* 12: 642-656, June 1960. (Roswell Park Memorial Institute, Buffalo, N. Y.)

The author reports a comparison of the effects of x-irradiation on different tissues and an investigation of the mechanism of regression or resorption after irradiation.

The hind limbs of 44 adult axolotls were amputated in the femoral region. Seventy-nine days later the right hind-limb regenerates of 22 animals were irradiated locally with 4,000 r and those of 12 animals with 6,000 r. The unirradiated left hind-limb regenerates served as controls. In 90 per cent of the animals irradiated with 4,000 r and in all those receiving 6,000 r, reduction of the regenerates was observed, beginning in the distal end and progressing proximally. The skin epithelium reduced gradually without the formation of open wounds. Histologic investigation revealed that the condition of the skin epithelium depended on the interval between irradiation and fixation. In most cases, early fixation disclosed epithelial damage, i.e., formation of giant-cell degenerating epithelium, whereas late fixation showed normal epithelium.

Reduction of the cartilaginous and bony skeleton is a result of macrophage activity. The attack of macrophages in the skeletal elements always starts from the surface. Bone and cartilage are dissolved as a result of the action of lytic enzymes secreted by macrophages located near the skeletal surface. Comparatively small macrophages penetrate deeply into the cartilaginous substance and dissolve the cartilage, forming many empty spaces in various places. Such spaces are never seen in normal cartilage.

During reduction, the compact muscle bundles are transformed into isolated small, thin bundles or even isolated irregularly oriented fibrils. Macrophages are found between them. Damage, which is independent of the macrophages, i.e., vacuolization of muscle protoplasm, is rarely evident.

Damage of blood vessels typically appears in limbs undergoing reduction. All distal capillaries and small vessels are destroyed, and many of the large vessels are transformed into large sinuses.

The reduction process is an inflammatory reaction to local irradiation. Inflammatory stimuli attract the macrophages from nonirradiated portions of the body. Reduction occurs as a result of their activity. The important features of this process are reduction of the skeleton and destruction of blood vessels. These two primary processes create favorable conditions for the reduction of all other tissues.

Seventeen figures; 1 table. AUTHOR'S SUMMARY

**Bioelectric Activity of Mammalian Nerves During X-Irradiation.** C. S. Bachofer and M. E. Gautreaux. *Radiation Res.* 12: 575-586, May 1960. (University of Notre Dame, Notre Dame, Ind.)

The effect of x-rays on certain bioelectric responses, *in vitro*, of the ventral caudal nerves of the rat was investigated. Electronic stimulation was used to determine the amplitude of the action potential and the conduction velocity of the propagated impulse, as well as the sensitivity of the nerve to stimulation. These values were determined before and during exposure to x-rays. Considerable increases in spike amplitude were noted very soon after the beginning of irradiation, with lesser increases for sensitivity and for conduction velocity. Each factor investigated reached its maximum and declined at a time quite independent of the time at which the other factors reached their maxima. This indicated independence of controlling mechanisms. The action of x-rays was not synergistic in that the x-ray beam could be cut off and the nerve would continue to respond for some time in its enhanced condition. The response, in fact, would continue to rise if it was in the rising phase when the x-ray beam was cut off, and continue to fall if it was in the falling phase; the rise or fall proceeded at slower rates when the x-ray beam was cut off. The rise did not continue indefinitely but reached a certain peak, after which the activity declined and ultimately fell to a level at which no response could be elicited. Stimulation at 50/sec. and 100/sec. caused a decline in the activity of the nerve. Once this decline was compensated for, the effect of irradiation was evident: Stimulation at higher frequencies reduced considerably the enhancement of spike amplitude attributable to x-rays, showed a somewhat lesser effect on enhancement of sensitivity, and showed no effect on enhancement of conduction velocity. Nerves under stimulation and irradiation failed to respond as long as nerves under irradiation alone.

Seven figures.

AUTHORS' SUMMARY

**Delayed Hypersensitivity. V. The Effect of X-Irradiation on the Development of Delayed Hypersensitivity and Antibody Formation.** Jonathan W. Uhr and Matthew Scharff. *J. Exper. Med.* 112: 65-76, July 1, 1960. (M. S., Harvard Medical Service, Boston City Hospital, Boston, Mass.)

In previous studies it was reported that delayed-type hypersensitivity to diphtheria toxoid may develop in irradiated guinea-pigs even under conditions when detectable antitoxin could not be produced (*J. Clin. Invest.* 38: 1049, 1959). The present report describes these findings and their extension to a second species, the rabbit, and to other antigen-antibody systems.

It was found that the capacity to develop the delayed type of hypersensitivity to diphtheria toxoid and ovalbumin may persist in guinea-pigs and rabbits that have received roentgen doses sufficient to eliminate a detectable antibody response. Larger doses of x-irradiation can prevent development of delayed-type hypersensitivity in rabbits.

Irradiated immunized animals that cannot form detectable serum antibody usually retain the capacity to exhibit the delayed type of hypersensitivity. Analogous results were obtained in a species in which delayed-type hypersensitivity is readily induced (guinea-pig) and in a second species more refractory to its development (rabbit). There are at least two interpretations that may account for these results: (a) The develop-

During  
tereaux.  
iversity  
sponses,  
was in-  
to deter-  
the con-  
well as  
These  
sure to  
de were  
n, with  
ion ve-  
maximum  
time at  
This in-  
. The  
x-ray  
tinue to  
. The  
in the  
d con-  
or fall  
as cut  
reached  
d and  
ould be  
ised a  
ecline  
s evi-  
con-  
tribu-  
ct on  
ct on  
nder  
long

RY

X-Ir-  
ensi-  
and  
ly 1,  
City

type  
p in  
when  
clin.  
ibes  
cicies,  
yed  
val-  
ave  
ect-  
ion  
nsi-

de-  
to  
lo-  
ed-  
(ig)  
op-  
ns  
op-

ment of the delayed type of hypersensitivity depends upon a different mechanism from that of antibody formation and is more resistant to x-irradiation. (b) The development of both these immune responses depends upon the same mechanism but the delayed type of hypersensitivity is a more sensitive expression of antibody formation than other conventional serologic tests. Because of the lack of information about the relative sensitivities of the test systems used, neither explanation can be excluded at present.

In contrast to the relative radiosensitivity of the primary antibody response, the capacity to reject homografts, the specific anamnestic antibody response, and, in the authors' studies, the delayed type of hypersensitivity are relatively radioresistant. The radioresistance of these latter immune responses might be due to a common underlying mechanism. Numerous investigators have suggested that delayed-type hypersensitivity is the mechanism underlying the homotransplantation reaction and the hypothesis has been advanced that it

may similarly be responsible for the characteristic features of the specific anamnestic response. It is known that 800 r before secondary antigen challenge affects but does not eliminate the anamnestic response, but it does suppress the transplantation reaction to homologous bone marrow in at least 15 per cent of rabbits. The authors' studies demonstrated that 800 r prior to sensitization with toxoid or ovalbumin prevented delayed-type skin reactions in all instances.

An interesting fact to emerge from these studies is the greater sensitivity of a test for antibody which has become "fixed" to skin, compared to methods for detecting circulating antibody. The probable explanation for the findings is based on the known capacity of guinea-pig tissues, notably skin, to bind efficiently gamma globulin. Presumably, if antibody production is small, antibody may be removed from the circulation by "fixation" to tissues more rapidly than it is released into the circulation from sites of antibody production.

Three photomicrographs; 2 graphs; 4 tables.



## INDEX TO VOLUME 76

### A

**AABERG, THOMAS A.** See **BERNSTEIN, EUGENE F.**

**ABBOTT, WILLIAM E., KRIEGER, H., LEVEY, S., and BRADSHAW, J.**: The etiology and management of the dumping syndrome following a gastroenterostomy or subtotal gastrectomy (ab), May, 847

—See **STORAASLI, JOHN P.**

**ABDOMEN**  
See also under names of abdominal organs and structures  
acute conditions  
—intravenous cholecysto-cholangiography in emergency abdominal diagnosis (ab), William G. Meyer, June, 988  
—radiology in surgery of "acute abdomen" (ab), H. Dendy Moore, April, 674  
—use of contrast medium in investigation of acute abdomen (ab), Eric Samuel, April, 674

**roentgenography.** See also other subheads under **Abdomen**  
—findings on plain roentgenograms of the abdomen associated with mesenteric vascular occlusion with a possible new sign of mesenteric venous thrombosis (ab), Sidney W. Nelson and William Eggleston, March, 504

**tumors**  
—radiology in diagnosis of retroperitoneal tumors (ab), R. A. Kemp Harper, Feb., 335  
—retroperitoneal tumors (ab), I. G. Williams, Feb., 338

**ABDUCTION TEST.** See **Hip, dislocations**

**ABNORMALITIES AND DEFORMITIES**  
See also **Heart, abnormalities; Lungs, abnormalities; etc.**  
—malformation syndrome in man associated with triploidy (69 chromosomes) (ab), J. A. Book and Berta Santesson, June, 988

**ABRANTES, F. JORGE.** See **CULVER, GORDON J.**

**ABSOLON, KAREL E., LONG, SISTER VICTORINE, and HUNTER, SAMUEL W.**: An experimental study of the diagnosis of mesenteric infarction (ab), March, 505

**ABURANO, AKIO.** See **BRENT, LAWRENCE B.**

**ACCURACY**  
—identification of "positives" in roentgenographic readings (ab), Joseph Berkson et al, March, 496

**ACHONDROPLASIA**  
—chondrodystrophy congenita punctata (Conradi's disease); review of literature and report of case with unusual features (ab), Mathew Allansmith and Edward Senz, May, 851

**ACID**  
amino. See **Amino Acids**  
deoxyribonucleic. See **Nucleins**  
iopanoic. See **Gallbladder, roentgenography**  
ortho-iodophippuric. See **Kidneys, function tests**

**ACKLAND, T. H., HOLMAN, W. P., and STOLL, B. A.**: The management of early breast cancer (ab), March, 519

**ACROMEGALY**  
—pituitary irradiation for acromegaly, Glenn E. Sheline, Minnie B. Goldberg and Robert Feldman, Jan., 70

**ACTINOMYCIN D**  
—in vitro effects of irradiation combined with actinomycin D, Paul Y. M. Chan and Edwin J. Liebner, Feb., 273

**ACTINOMYCOSIS**  
—actinomycosis with involvement of vertebral column; case report and review of literature (ab), W. B. Young, May, 852

**ADAGLIO, L.** See **AGATI, G.**

**ADAMANTINOMA.** See **Tumors, adamantinoma**

**ADAMS, KAY.** See **LAMERTON, L. F.**

**ADAMS, PAUL.** See **LESTER, RICHARD G.**

**ADDISON'S ANEMIA.** See **Anemia, pernicious**

**ADENOIDECTOMY.** See **Adenoids**

**ADENOIDS**  
—blood loss during adenoidectomy and tonsillectomy measured with radioisotopes (ab), R. L. Ruggles, April, 694

**ADENOMA.** See **Parathyroid, tumors**

**ADENOMA SEBACEUM.** See **Sebaceous Glands**

**ADOLESCENCE**  
—intervertebral disk protrusions in childhood and adolescence (ab), John E. A. O'Connell, March, 513

**ADRENALECTOMY.** See **Adrenals, excision**

**ADRENALS**  
See also **Adrenocortical Preparations; Cushing's Syndrome**  
calcification. See **Adrenals, tumors**  
cancer  
—nonfunctioning carcinoma of adrenal cortex (ab), Charles D. Knight et al, Feb., 335

cysts. See **Adrenals, tumors**  
effects of irradiation  
—effect of irradiation to adrenal upon circulating adrenal cortical hormone in rat, M. G. Griffith, J. Q. Griffith, Jr., M. B. Hermel and J. Gershon-Cohen, Jan., 110

—radiation injury: adrenocortical and gastric responses in rat (ab), D. G. Baker et al, May, 863

excision  
—palliation of osseous metastases from breast carcinoma with radioactive phosphorus alone and in combination with adrenalectomy, John P. Storaasli, Richard L. King, Harvey Krieger, William E. Abbott and Hymer L. Friedell, March, 422

secretion. See **Adrenals, effects of irradiation**  
tumors  
—inferior vena cavaography in preoperative localization of pheochromocytoma (ab), Ronald R. Lund et al, March, 517

—pheochromocytoma with large cystic calcification and associated sphenoid ridge malformation, John H. Feist and Elliott C. Lasser, Jan., 21

—roentgen diagnosis of adrenal tumor in Cushing's syndrome (ab), A. Iannaccone et al, April, 685

**ADRENOCORTICAL PREPARATIONS**  
—cortisone and irradiation. II. Pulmonary necrosis and blood vessel impairment in irradiated cortisone-treated rat lung (ab), Charles C. Berdjis, April, 698

—cortisone and irradiation. III. Histopathology of effect of cortisone on irradiated rat kidney (ab), Charles C. Berdjis, April, 699

—effect of corticosteroids and gluten-free diet on absorption of iron in idiopathic steatorrhea and celiac disease (ab), John Badenoch and Sheila T. Callender, June, 994

—radiation reaction in lung; report of fatal case in patient with carcinoma of lung, with studies of pulmonary function before and during prednisone therapy (ab), Theodore Rodman et al, Feb., 347

—steroid arthropathy of hip (ab), D. R. Sweetnam et al, March, 514

**AEET**  
—failure of AET to protect against testes injury in x-irradiated rat (ab), B. H. Ershoff and V. Brat, Feb., 349

**AGAMMAGLOBULINEMIA.** See **Gamma Globulin**

**AGATI, G., and ADAGLIO, L.**: Clinical and radiologic considerations on symptomatic laryngocoele (ab), June, 986

—and PRIGIONE, D.: Roentgen investigation of pregnancy with triplets, including twin thoracopagus (ab), June, 989

**AGE.** See **Old Age**

**AGNEW, COLVIN H.**: Renal angiography records information about the renal arterial system (ab), Feb., 333

—See **HARDIN, CREIGHTON A.**

**AGUIRRE, JORGE.** See **AMPLATZ, KURT**

**AHO, A.** See **VARTIO, T.**

**AIKAWA, JERRY K.** See **BRETTELL, HERBERT R.**

**AKAHOSHI, YOSHIIHIKO.** See **FERGUSON, ALBERT B., Jr.**

**ALBAUM, HARRY G.**: Serum enzymes following whole-body radiation in the rabbit (ab), May, 864

**ALBERS-SCHÖNBERG'S DISEASE.** See **Osteosclerosis fragilis**

**ALBUMIN.** See **Blood, proteins**

**ALDERSON, D. A.**: The reliability of Telepaque cholecystography (ab), March, 509

**ALDRIDGE, HAROLD E., and GREENWOOD, WILLIAM F.**: Myxoma of the left atrium (ab), April, 665

**ALEXANDER, COLIN.**: Erosion of the femoral shaft due to patello-femoral osteoarthritis (ab), March, 514

**ALEXANDER, JOHN S.** See **IBARRA, JESSE D., Jr.**

**ALEXANDER, PETER, and CONNELL, DOROTHÉA I.**: Shortening of the life span of mice by irradiation with x-rays and treatment with radiomimetic chemicals (ab), April, 700

**ALIMENTARY TRACT.** See **Gastrointestinal Tract**

**ALLANSMITH, MATHEA, and SENZ, EDWARD.**: Chondro-dystrophy congenita punctata (Conradi's disease). Review of literature and report of case with unusual features (ab), May, 851

**ALLEN, R. PARKER.** See **CONDON, VIRGIL R.**

—See **SHOPFNER, CHARLES E.**

**ALLEN, RALPH G., BROWN, FRANK A., LOGIE, LOREN C., ROVNER, DAVID R., WILSON, STEPHEN G., Jr., and ZELLMER, ROBERT W.**: Acute effects of gamma radiation in primates (ab), June, 996

**ALPEN, E. L., SHILL, O. S., and TOCHILIN, E.**: The effects of total-body irradiation of dogs with simulated fission neutrons (ab), May, 865

**ALTITUDE**  
—species differences in altitude tolerance following x-irradiation (ab), Bernard D. Newsom and Donald J. Kimeldorf, March, 529

**ALTMAN, DONALD H., and SMITH, RICHARD L.**: Unrecognized trauma in infants and children (ab), Feb., 327

—See **SMITH, GEORGE F.**

**ALVEOLAR PROCESS.** See **Jaws**

**AMATO, C. G., and MALSKY, S. J.**: Radiophotoluminescent gamma-ray dosimetry of mixed neutron gamma-ray radiation fields, Feb., 290. See also **correction**, May, 830

—**MALSKY, S. J., BOND, V. P., and ROSWIT, B.**: Multiple implant dosimetry, Feb., 292

—See **ROSWIT, B.**

**AMBERG, JOHN R.**: Accuracy of roentgen diagnosis in carcinoma of the stomach (ab), Feb., 321

**AMBESI, IMPIOMBATO, G., CHELAZZI, M., and MILANESI, R.**: Treatment of carcinoma of the cervix with radium and telecobalt (ab), June, 993

**AMEBIASIS**  
—pneumopulmonary amebiasis; review with analysis of 10 cases (ab), B. H. Webster, March, 499

**AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE,** March, 486

**AMERICAN CANCER SOCIETY,** Scientific Session, June, 979

**AMERICAN COLLEGE OF RADIOLOGY**

- announcement of February 1961 meeting, Jan., 130
- graduate programs in the radiological basic sciences, Frederick J. Bonte, for the Commission on Education, June, 973

**AMMETOPTERIN**

- hypogastric arteriography prior to continuous infusion of malignant tumors of uterine cervix and vagina; preliminary report (ab), Paul R. Zeit et al, May, 846

**AMINO ACIDS**

- prompt effects of high-level irradiation on animal metabolism (ab), James P. Ellis, Jr., et al, April, 697

**AMNIOTIC FLUID**

- amniotic circulation studied with  $I^{131}$  (ab), M. Cottafavi and P. Mentasti, March, 525

**AMPLATZ, KURT, AGUIRRE, JORGE, and LILLEHEI, C.**

**WALTON:** Coronary arteriovenous fistula into main pulmonary artery. Preoperative diagnosis by selective aortography (ab), Feb., 319

**See LESTER, RICHARD G.**

**LESTER, RICHARD G., ERNST, RICHARD, and LILLEHEI, C.**

**WALTON:** Left retrograde cardioangiography: its diagnostic value in acquired and congenital heart disease, March, 393

**AMROMIN, GEORGE.** See GILDENHORN, HYMAN L.

**ANAPHYLAXIS AND ALLERGY**

See also Encephalomyelitis

- pneumatoic cystoides intestinalis (report of 16 cases in patients with history of asthma and allergy) (ab), Howard P. Doub and James J. Shea, Jan., 157

**ANDERLE, SONIA K.** See MILLER, C. PHILLIP.

**ANDERSON, G. K.** See SMIDDY, F. G.

**ANDERSON, RAY C.** See LESTER, RICHARD G.

**ANDRÉN, LARS, and THEANDER, GEORG:** Residual contrast medium in the bowel in cholecystography with iopanoic acid and certain related substances (ab), April, 680

**—and WELIN, SÖLVE:** Frequency of polyps of the colon in ulcerative colitis (ab), March, 508

**ANDREWS, HOWARD L.**: Survival time following massive fractionated irradiation (ab), May, 863

**ANDREWS, J. ROBERT.** See SUIT, HERMAN D.

**ANDROGENS**

- do estrogenic and androgenic hormones affect the radiation reaction of tumors? Henry P. Plenk, Fred M. Sorenson and Roger B. Fuson, Feb., 270
- value of an early change in hormonal status through suspension of ovarian function and application of androgens in therapy of advanced mammary carcinoma: experiences with prophylactic x-ray castration in 284 patients (ab), Hanno Poppe and Anton Gregl, March, 519

**ANEMIA**

- anemia of hepatic disease studied with radiochromium (ab), Madison J. Cawein, III, et al, Feb., 345
- isotope chromium 51: evaluation of selected anemias with radioactive material (ab), John H. Wineinger et al, Feb., 345
- Addison's. See Anemia, pernicious
- hemolytic
- pattern of erythrocyte destruction in hemolytic anemia, as studied with radioactive chromium (ab), S. M. Lewis et al, Feb., 345
- hypochromic
- radioactive iron studies in patients with iron deficiency anemia with concurrent abnormal hemolysis (ab), M. C. Verlooper et al, June, 994
- iron-deficiency. See Anemia, hypochromic
- pernicious
- kinetics of intravenously injected radioactive vitamin B<sub>12</sub>; studies on normal subjects and patients with chronic myelocytic leukemia and pernicious anemia (ab), Eugene A. Brody et al, June, 995
- malabsorption syndromes: a symposium. III. Hematological diagnosis of Addisonian pernicious anemia and the intestinal malabsorption syndrome (ab), D. L. Mollin, April, 678
- malabsorption syndromes: a symposium. IV. Radiological features of pernicious anemia (ab), J. W. Laws and R. G. Pitman, April, 679
- malabsorption syndromes: a symposium. V. Histopathology of stomach in pernicious anemia and jejunum in steatorrhea (ab), I. Doniach and Margot Shiner, April, 679

**ANESTHESIA**

- x-ray study of passage of air through pharynx in anesthetized patients (ab), H. Ruben et al, June, 986
- butoxypiperidinopropiophenone. See Bronchi, roentgenography
- lidocaine
- tonic muscle spasm and blood pressure changes following subarachnoid injection of contrast media. Experimental study in dogs with injection of Kontrast U and mixtures of Kontrast U and Xylocaine (lidocaine) (ab), B. Funkquist and N. Obel, April, 687

**ANEURYSM**

- aortic
- dissecting aneurysm of aorta (ab), S. Holesh, May, 843
- dissecting aneurysm of aorta (ab), Alexander N. Rota and S. L. Fransman, Jan., 149
- kinking of aortic arch associated with fusiform aneurysmal dilation (ab), A. F. Barrett and G. I. Verney, March, 502
- traumatic aneurysm of thoracic aorta (ab), R. S. MacIntyre, April, 667
- cerebral
- carotid-basilar anastomosis associated with multiple aneurysms and other anomalies (ab), H.-St. Meyer and G. Busch, April, 660

**dissecting.** See also Aneurysm, aortic

- arteriography in diagnosis of dissecting aneurysm (ab), David Sutton, March, 503

**ANGIOPATHY:** See Cardiovascular System; Heart, endocardial fibroelastosis

**ANGIOGRAPHY:** See Arteries; Brain, blood supply; Extremities, tumors; Kidneys, blood supply; etc.

**ANALYSIS**

See also Tumors, experimental; Tumors, in animals

- disease conditions in animals, with radiographic findings that are also present in man, Stuart A. Patterson, May, 818

**ANKLE**

- talar-tilt angle and fibular collateral ligaments: method for determination of talar tilt (ab), Gustav Rubin and Morris Witten, Jan., 161

**ANOXIA.** See Oxygen

**ANTHOPHYLLITE-ASBESTOS.** See Asbestosis

**ANTIBODIES:** See Antigens and Antibodies

**ANTIGENS AND ANTIBODIES**

- delayed hypersensitivity. V. Effect of x-irradiation on the development of delayed hypersensitivity and antibody formation (ab), Jonathan W. Uhr and Matthew Scharff, June, 998

**ANTRUM OF HIGHMORE.** See Maxillary Sinus

**AORTA**

- coronary arteriography. I. Differential opacification of aortic stream by catheters of special design—experimental development (ab), Sven Bellman et al, Jan., 149
- estradiol reduces incorporation of radioactive sulfate into cartilage and aortas of rats (ab), Robert E. Priest et al, May, 861
- abnormalities
- differential diagnosis of Taussig-Bing heart from complete transposition of great vessels with a posteriorly overriding pulmonary artery (ab), Alois Beuren, May, 843
- kinking of aortic arch associated with fusiform aneurysmal dilation (ab), A. F. Barrett and G. I. Verney, March, 502
- roentgen diagnosis of congenitally corrected transposition of great vessels (ab), Richard G. Lester et al, April, 666
- supravalvular aortic stenosis with hypoplasia of aorta (ab), M. Herbst et al, March, 502

**aneurysm.** See Aneurysm, aortic

**roentgenography**

- calcification of the aortic knob: its relationship to fifth and sixth embryonic aortic arches: a radiological and anatomical study, F. Dalith, Feb., 213
- coronary arteriovenous fistula into main pulmonary artery: preoperative diagnosis by selective aortography (ab), Kurt Amplatz et al, Feb., 319
- differentiation "nephropacification": a screening procedure for unilateral renal artery occlusion, John C. Rathe, April, 629
- discovertebral necrosis after aortography (ab), M. Demoulin, March, 502
- experiences with angiography as guide to mediastinal exploration (ab), Owings W. Kincaid et al, April, 669
- intravenous aortography: technic and clinical aspects (ab), Richard H. Greenspan et al, April, 667
- necrosis of entire gastrointestinal tract following translumbar aortography (ab), Robert J. Wilder and Felicien M. Steichen, Jan., 149
- studies in visceral arteriography (ab), Murray W. Seitchik et al, June, 987
- studies of toxicity of Hypaque-90 per cent, following rapid intravenous injection, Eugene F. Bernstein, John D. Palmer, Thomas A. Aaberg and Richard L. Davis, Jan., 88
- unilateral renal damage after translumbar aortography (ab), G. Pigeon et al, May, 844
- stricture
- supravalvular aortic stenosis with hypoplasia of aorta (ab), M. Herbst et al, March, 502
- wounds and injuries. See Aneurysm, aortic

**AORTIC VALVE**

- familial muscular subaortic stenosis: an unrecognized form of "idiopathic heart disease," with clinical and autopsy observations (ab), Lawrence B. Brent et al, Feb., 318
- surgical correction of aortic insufficiency associated with ventricular septal defect (ab), Albert Starr et al, May, 843

**ORTOGRAPHY.** See Aorta, roentgenography

**APPARATUS.** See Counters and Counting; Roentgen Rays, apparatus; etc.

**APPENDIX**

**calculi**

- clinical and radiographic study of appendiceal calculi; review of literature and report of 7 cases (ab), Robert Carras and Marvin J. Friedenberg, Feb., 325

**APPLICATORS.** See Radioactivity, radiostrontium; Radium, therapy; Uterus, cancer

**ARACHNOID**

- multiple arachnoid diverticula (ab), Paul Teng and Nathan Rudner, Jan., 172

**ARDEN, ANNE.** See JENNINGS, F. LAMONT

**ARDEN, G. P.**: Radioactive isotopes in fractures of the neck of the femur (ab), Jan., 174

**ARIANOFF, A. A., and HENRARD, E. H.**: Cholangiomanometric interpretation of lesions in the main biliary duct: 800 peroperative examinations (ab), April, 680

**ARIDA, EDWARD J.** See HEMLEY, SAMUEL D.

**ARIEL, IRVING M., and PACK, GEORGE T.**: The treatment of inoperable cancer of the biliary system with radioactive (<sup>131</sup>I) rose bengal (ab), Jan., 173

**ARTERIES**

- cause and treatment of edema of arm following radical mastectomy (ab), Magnus I. Smedal and James A. Evans, May, 856
- See also Aneurysm; Aorta; Arteriosclerosis; Cardiovascular System; Embolism; Lungs, blood supply; Thrombosis
- arterial malformation in superior mediastinum (ab), S. Brunner et al., Jan., 148
- some aspects of microcirculation of a transplantable experimental tumor, Morton M. Kligerman and Dora K. Henel, May, 810
- carotid-basilar anastomosis associated with multiple aneurysms and other anomalies (ab), H.-St. Meyer and G. Busch, April, 603
- basilar
  - normal brachial cerebral angiogram (ab), Robert A. Kuhn, June, 984
- carotid. See also Thrombosis
- carotid-basilar anastomosis associated with multiple aneurysms and other anomalies (ab), H.-St. Meyer and G. Busch, April, 600
- false block of internal carotid artery during angiography, William E. Gannon, May, 748
- vertebral arteriography by retrograde injection of right common carotid artery, George T. Tindall and Horace B. Capp, Jr., May, 712
- cerebral
  - bilateral anomalies of middle cerebral artery in recurrent subarachnoid hemorrhage; case (ab), Olli Höök and Georg-Fredrik Saltzman, Feb., 312
  - measurement of anterior cerebral artery in normal and abnormal cerebral arteriograms (ab), Richard M. Freidenberg et al., June, 984
- choroid
  - medial and lateral choroid arteries: an anatomic and roentgenographic study (ab), James R. Galloway and Torgny Greitz, April, 672
- coronary. See Coronary Vessels
- diseases. See Extremities, blood supply
- femoral
  - serial femoral arteriography in occlusive disease: clinical-roentgenologic considerations with new classification of occlusive patterns (ab), Henry Haimovici et al., April, 670
- gastric
  - relationship between ulcers in aged and radiologically demonstrated calcification of left gastric artery (ab), J. Holstein and A. Stecken, April, 676
- hypogastric
  - hypogastric arteriography prior to continuous infusion of malignant tumors of uterine cervix and vagina; preliminary report (ab), Paul R. Zeit et al., May, 846
- mesenteric. See also Thrombosis, mesenteric
  - arteriomesenteric occlusion of the duodenum: an entity? (ed), Christian V. Cimmino, May, 828
  - experimental study of diagnosis of mesenteric infarction (ab), Karel E. Absolon et al., March, 505
  - infarction of descending colon due to vascular occlusion: 3 cases (ab), James J. McCort, Jan., 155
  - mesenteric vascular disease (ab), C. C. Wang and John D. Reeves, March, 504
- occlusion. See Arteries, femoral; Arteries, mesenteric; Arteries, renal; Extremities, blood supply
- pulmonary. See also Lungs, blood supply
  - coronary arteriovenous fistula into main pulmonary artery: preoperative diagnosis by selective aortography (ab), Kurt Amplatz et al., Feb., 319
  - differential diagnosis of Taussig-Bing heart from complete transposition of great vessels with a posteriorly overriding pulmonary artery (ab), Alois Beuren, May, 843
  - hypertranslucency of one lung field and its experimental production by unilateral miliary embolization of pulmonary arteries in cats (ab), R. F. Fouché and J. L. D'Silva, March, 501
  - idiopathic dilatation of pulmonary artery (ab), Madhukar Deshmukh et al., March, 503
  - roentgen evaluation of pulmonary arterial pressure in mitral stenosis, Philip M. Johnson, Ernest H. Wood, Bernard S. Pasternack and Morris A. Jones, April, 541
- roentgenologic diagnosis of congenitally corrected transposition of great vessels (ab), Richard G. Lester et al., April, 666
- stenosis of right main pulmonary artery. Clinical, angiographic, and catheterization findings in 10 patients (ab), Lawrence L. Luan et al., May, 844
- renal. See also Kidneys, blood supply
  - diagnosis and treatment of renal-artery stenosis (ab), J. J. Brown et al., May, 845
  - differential "nephropacification": screening procedure for unilateral renal artery occlusion, John C. Rathe, April, 629
  - renal arteries: an evaluation of roentgen methods of opacification, Samuel D. Hemley, Edward J. Arida and Edward M. Ring, March, 402
  - report of case of injection of massive dose of Urographin into renal artery (ab), W. M. L. Laubscher and F. P. Raper, June, 990
- roentgen diagnosis of fibromuscular hyperplasia of renal arteries, A. J. Palubinskas and Edwin J. Wyble, April, 634
- surgical treatment of renal hypertension (ab), George C. Morris, Jr., et al., May, 845
- roentgenography. See also Aneurysm, dissecting; Aorta; Pelvis, blood supply; Viscera; other subheads under Arteries, etc.
  - arteriographic demonstration of stationary arterial waves (ab), Georg Theander, April, 609
  - left ventricular and systemic arterial catheterization: a simple percutaneous method using a spring guide (ab), Charles T. Dotter, April, 671
  - technics of arteriography (ab), James Kalokerinos and G. D. Tracy, March, 305
  - value of peripheral arteriography in assessing acute vascular injuries (ab), William H. Sinkler and Andrew D. Spencer, Jan., 150
- surgery
  - effect of whole-body radiation and infection on arterial replacement (ab), Richard W. Hardy et al., Feb., 350
  - late behavior of vascular substitutes: 3 to 5 year follow-up of arterial homografts and synthetic prostheses in experimental animals (ab), John H. Foster et al., May, 847
- vertebral
  - injection into vertebral artery via the posterior route (ab), G. Dolce and G. Ramella, May, 810
  - vertebral angiography: analysis of 106 cases, Robert Momes, Feb., 230
  - vertebral angiography in diagnosis of meningioma within lateral ventricle (ab), Vincent Rogers, March, 493
  - vertebral arteriography by retrograde injection of right common carotid artery, George T. Tindall and Horace B. Capp, Jr., May, 712
  - vertebral arteriography of benign tumors (ab), A. Isfort, April, 600

**ARTERIOGRAPHY:** See Aorta; Arteries; Coronary Vessels; Pelvis, etc.

**ARTERIOSCLEROSIS**

- See also Coronary Vessels
- measurement of myocardial blood flow: radioisotope techniques used in patients with normal and arteriosclerotic hearts after infarction (ab), Philip C. Johnson and Gunnar Sevelius, May, 837

**ARTHROSIS**

- See also Hip; Spine
- roentgenographic diagnosis of arthritis (ab), Ralph C. Quillin, June, 988

**ASBESTOSIS**

- pleural calcification as roentgenologic sign of nonoccupational endemic anthophyllite-asbestosis (ab), Raimo Kiviluoto, April, 662

**ASCARIASIS**

- intravenous cholangiography and tomography as an aid in diagnosis of ascariasis of the biliary tract (ab), S. Cywes and H. Krig, April, 680

**ASCITES**

- massive neonatal ascites, Olga M. Baghassarian, P. Ruben Koehler and Gunter Schultz, April, 586
- relative biological effect of various qualities of x-rays on growth of ascites tumor cells (ab), Norman A. Baily and Ruth A. Brother, May, 866

**ASH, C. L., WRIGHT, D. J., and JOHNS, H. E.**: The dual-purpose cesium unit for radiotherapy, Feb., 284

**ASHLEY, CHARLES A.** See MANNICK, JOHN A.

**ASHMAN, HYMAN, ZAROFF, LAWRENCE I., and BAROFSKY, IVAN.**: Right atrial myxoma. Diagnosis during life; successful surgical removal (ab), Feb., 318

**ASPER, SAMUEL P., Jr.** See WILSON, E. HUNTER

**ASPERGILLOSIS**

- pulmonary aspergillosis (ab), Angelo Toigo, March, 498
- pulmonary aspergillosis with cavitation secondary to histoplasmosis (ab), John J. Procknow and David F. Loewen, May, 841

**ASPIN, N., JOHNS, H. E., and HORSLEY, R. J.**: Depth-dose data for rectangular fields, Jan., 76

**ASTHMA**

- bronchial wall thickening in asthma (ab), C. J. Hodson and S. E. Trickey, May, 842
- periarteritis nodosa with labile and recurrent pleuropulmonary manifestations without asthma or serum hyperesinophilia (ab), J. Turiaf et al., Feb., 316
- pneumatoses cystoides intestinalis (report of 16 cases in patients with history of asthma and allergy) (ab), Howard P. Doub and James J. Shea, Jan., 157

**ATELECTASIS.** See Lungs, collapse

**ATHLETICS**  
—athlete's kidney (ab), A. K. Kleiman, Feb., 334

**ATLAS AND AXIS**  
See also Platibasias

—laminography in follow-up of fractures of odontoid process (ab), Julius Solovay and Gratián B. Brice, Feb., 313

**ATOMIC BOMB AND ATOMIC ENERGY**  
—initial clinical reaction to therapeutic whole-body roentgen radiation: some civil defense considerations (ab), William C. Levin et al., Jan., 177

—leukemia in Hiroshima atomic bomb survivors (ab), Robert Heysel et al., Feb., 348

**AUTOGRAFTS.** See Bones, marrow

**AUTORADIOGRAPHY.** See Radioactivity

**AVANT, ROBERT F.** See BERNSTEIN, EUGENE F.

**AWWAAD, A., and REDA, M.**: Osteogenesis imperfecta: review of literature with a report on three cases (ab), May, 850

**AWWAD, H. K.** See MASSOUD, G. E.

**AYRES, STEPHEN M., and LUKAS, DANIEL S.**: Mild pulmonary stenosis: a clinical and hemodynamic study of eleven cases (ab), April, 666

**AXIS.** See Atlas and Axis

**B**

**"B" LINES.** See Lungs, roentgenography

**BACHOFER, C. S., and GAUTEREAUX, M. E.**: Bioelectric activity of mammalian nerves during x-irradiation (ab), June, 998

Bioclectric responses in situ of mammalian nerves exposed to x-rays (ab), March, 529

**BACKACHE**  
—backache from lumbosacral instability (ab), Maurice H. Herzman, Feb., 331

—low back disorders: value of radiographs of dorsal vertebrae in evaluating etiology of lumbosacral derangements (ab), C. J. Sutro et al., Feb., 331

**BACLESSE, F., ENNUYER, A., and CALLE, R.**: Epitheliomas of the maxillary sinus treated with external roentgen therapy alone. Results at five years (ab), April, 689

**BACTERIA**  
—studies on susceptibility to infection following ionizing radiation. V. Comparison of intraperitoneal and intravenous challenge at intervals following different doses of x-radiation (ab), C. Phillip Miller et al., April, 700

—relative biological efficiency of 20 MV and 4 MV radiations. Report from the Medical Research Council Group, Christie Hospital, Manchester 20 (England). IV. Experiments on survival of *E. coli* B (ab), W. M. Dale and C. Russell, March, 530

*salmonella.* See *Salmonella*

**BADENOCH, JOHN, and CALLENDER, SHEILA T.**: Effect of corticosteroids and gluten-free diet on absorption of iron in idiopathic steatorrhoea and celiac disease (ab), June, 994

**BAGHDASSARIAN, OLGA M., KOEHLER, P. RUBEN, and SCHULZTE, GUNTER.** Massive neonatal ascites, April, 586

**BAILY, NORMAN A., and BROTHER, RUTH A.**: The relative biological effect of various qualities of x-rays on growth of ascites tumor cells (ab), May, 866

—and MAYER, J. W.: A P-N junction semiconductor radiation detector for use with beta- and gamma-ray-emitting isotopes, Jan., 116

—and YODER, VIRGIL E.: Isodose curves for certain radium applicators used in the treatment of uterine cervical cancer (ab), Jan., 167

**BAKER, D. G., HUNTER, C. G., and SCHÖNBAUM, E.**: Radiation injury: adrenocortical and gastric responses in the rat (ab), May, 863

**BAKER, DAVID H.** See BIRCH, ANN McA.

**BAKER, HILLIER L., Jr.**: Intracranial sarcomas: their roentgenographic manifestations (ab), June, 984

**BAL.** See Diaphragm

**BALDRIGHI, V.** See DIGUGLIELMO, L.

**BALDUS, WILLIAM P., and PETER, JAMES B.**: Farmer's lung. Report of two cases (ab), Feb., 315

**BANFI, ALBERTO.** Pulmonary manifestations of lymphogranulomatosis (ab), June, 987

**BANNING, WILLIAM V.** See ERHARD, GERALD A.

**BARBER, H. STUART.** An unusual form of familial osteodystrophy (ab), June, 988

**BARIUM.** See Colon, roentgenography; Intestines, roentgenography; Radioactivity, radiobarium

**BARNES, MARY.** See FOCHT, ELIZABETH F.

**BARNETT, ELLIS, and NORDIN, B. E. C.**: The radiological diagnosis of osteoporosis: a new approach (ab), May, 831

**BARON, JOEL.** See SOLOMONS, EDWARD

**BARONOVSKY, IVAN.** See ASHMAN, HYMAN

—See SEITCHIK, MURRAY W.

**BARR, NATHANIEL F., STARK, MARY, and LAUGHLIN, J. S.**: A comparison of two fluorometers designed to measure the radiation-induced fluorescence of silver-activated glass rods, Jan., 113

**BARRETT, A. F., and VERNEY, G. I.**: Kinking of the aortic arch associated with fusiform aneurysmal dilation (ab), March, 502

**BARRIE, HERBERT.** See LIGHTWOOD, REGINALD

**BARTON, HARRY L., MGRANAHAN, G. M., Jr., and JORDAN, GEORGE L., Jr.**: The evaluation of roentgen therapy in the management of nonresectable carcinoma of the lung (ab), Jan., 160

**BASILAR IMPRESSION.** See Platibasias

**BASSET, G. (MME.).** See TURIAF, J.

**BATEMAN, A. J.**: The relative biological efficiency of 20 MV and 4 MV radiations. A report from the Medical Research Council Group, Christie Hospital, Manchester 20 (England). V. Induction of dominant lethal mutations in *Drosophila* sperm (ab), March, 530

**BAUM, F. K., and KUTTING, H.**: Application of television in supervoltage therapy (ab), Feb., 341

**BAUMAN, JUDAH.** See SOLOMONS, EDWARD

**BECHTOL, CHARLES O.** See MARMOR, LEONARD

**BEGG, A. C.**: Some radiological aspects of ischaemia of the brain (ab), March, 494

**BEHAVIOR**  
—radiation-induced conditioned avoidance behavior in rats, mice, and cats (ab), D. J. Kimeldorf et al., June, 996

—some factors which influence radiation-conditioned behavior of rats (ab), John Garcia and Donald J. Kimeldorf, June, 996

**BEIERWALTES, WILLIAM H.** See FLOYD, JOHN C., Jr.

**BEIQUE, R. A., and LOUGHEED, M. N.**: Considerations of shielding for cesium-137 sources containing cesium 134, Feb., 281

**BEISANG, ARTHUR.** See LOKEN, MERLE K.

**BEK, VÁCLAV.** See KOLÁR, JAROMÍR

**BELL, BERTRAND M.** See FÜRST, WILLIAM E.

**BELLET, SAMUEL.** See SANDBERG, HERSCHEL

**BELLION, B., and RESEGOOTTI, L.**: The life cycle of the erythrocytes of irradiated animals studied by means of  $Fe^{59}$  (ab), May, 859

**BELLMAN, SVEN, FRANK, HOWARD A., LAMBERT, PETER B., LITTMAN, DAVID, and WILLIAMS, JOHN A.**: Coronary arteriography. I. Differential opacification of the aortic stream by catheters of special design—experimental development (ab), Jan., 149

—See WILLIAMS, JOHN A.

**BELYAEV, Y. A.**: The employment of ion-exchange resins for the removal of plutonium from the gastrointestinal tract (ab), Feb., 348

**BENCOSME, SERGIO A., STONE, ROBERT S., LATA, HARRISON, and MADDEN, SIDNEY C.**: Acute tubular and glomerular lesions in rat kidneys after uranium injury (ab), April, 690

**BENDA, CLEMENS E.** See MELCHIOR, JOHANNES C.

**BENDITT, EARL P.** See PRIEST, ROBERT E.

**BENNETT, A. M. HASTIN**: A stereotaxic apparatus for use in cerebral surgery (ab), April, 687

**BENNETT, ROBERT**: Unequivocal radiological evidence of intra-uterine foetal death, including demonstration of gas movement within the foetal circulation: report of a case, and review of thirty-seven cases of foetal death (ab), May, 851

**BENTIVOGLIO, LAMBERTO.** See DESHMUKH, MADHUKAR

**BENTZEN, N.** See RUBEN, H.

**BÉRAUD, CL., DEFRENNIE, P., and BRESSIEUX, R.**: Value of tomography in the urographic study of infants and children (ab), March, 515

**BÉRAUD, TH.** See DORTA, T.

**BERCHTOOLD, R.**: Portal hypertension: its diagnosis, therapy, and prognosis (ab), Jan., 151

**BERDJIS, CHARLES C.**: Cortisone and irradiation. II. Pulmonary necrosis and blood vessel impairment in irradiated cortisone-treated rat lung (ab), April, 698

Cortisone and radiation. III. Histopathology of the effect of cortisone on the irradiated rat kidney (ab), April, 699

**BERG, H. MILTON**, President of the Radiological Society of North America (ed), Leo G. Rigler, Feb., 296

**BERKSON, JOSEPH, GOOD, C. ALLEN, CARR, DAVID T., and BRUWER, ANDRE J.**: Identification of "positives" in roentgenographic readings (ab), March, 496

**BERMAN, LEONARD.** See CULVER, GORDON J.

**BERMAN, MONES.** See BRAUER, EARLE W.

**BERNATZ, PHILIP E.** See KINCAID, OWINGS W.

**BERNE, ALFRED S.** See HEITZMAN, E. ROBERT

**BERNHARD, VICTOR, M.** See STARZL, T. E.

**BERNSTEIN, EUGENE F., EVANS, ROBERT L., BLUM, JOHN A., and AVANT, ROBERT F.**: Further experimental and early clinical observations concerning the protective action of low molecular weight dextran upon intravenous Hypaque toxicity, Feb., 260

—See GOODLIN, ROBERT C.

—See GREENSPAN, RICHARD H.

**PALMER, JOHN D., AABERG, THOMAS A., and DAVIS, RICHARD L.**: Studies of the toxicity of Hypaque-90 per cent, following rapid intravenous injection, Jan., 88

**BERNSTEIN, ROBERT.** See CHEITLIN, MELVIN D.

**BERSON, SOLOMON A.** See YALOW, ROSALYN S.

**BERTRAND, CHARLES A.** See GOLDEN, RICHARD L.

**BETA APPLICATORS.** See Radioactivity, radiostrontium

**BETA RAYS.** See Radioactivity; Tritium

**BETATRON**  
See also Electrons  
—betatron therapy of gynecologic cancers (ab), Gerhard Schubert et al., March, 520

**BETATRON, —cont.**

- electron-beam therapy of malignant tumors of mouth and jaw (ab), Friedhelm Oberheuser et al, March, 518
- relative biological efficiency of 20 Mrad and 4 Mrad radiations. Report from the Medical Research Council Group, Christie Hospital, Manchester 20 (England). Parts I-VII (ab), Ralston Paterson et al, March, 530
- technic of irradiation of epitheliomas of tonsil by combined external high-energy roentgen therapy (betatron, 22 Mev) and interstitial curie therapy ( $Au^{198}$  wires). Application of concept of two-volume targets (ab), B. Pierquin and M. Gasiorowski, April, 689

**BEUREN, ALOIS:** Differential diagnosis of the Taussig-Bing heart from complete transposition of the great vessels with a posteriorly overriding pulmonary artery (ab), May, 843

**BILE DUCTS**  
See also Biliary Tract; Gallbladder

- effect of Secergan on duodenum and common bile duct (ab), Paul Edholm, March, 511
- roentgenography**
  - accuracy of routine gallbladder and bile-duct studies (ab), Ward Shaver, March, 509
  - cholangiomanometric interpretation of lesions in main biliary duct: 800 peroperative examinations (ab), A. A. Ariano and E. H. Henrard, April, 680
  - cholecystography and cholangiography today (ab), James R. Riley, Jan., 157
  - cinechocholangiography, Stevens S. Sanderson and Kenneth E. Gross, Feb., 267
  - clinical aid in operative cholangiography (ab), John K. Stevenson and Lloyd M. Nyhus, April, 681
  - comparative assay of Biligrafin and orally effective cholangio-cholecystography contrast media (Biloptin and related substances) (ab), H. Ludin and Clara Lauchenauer, Feb., 327
  - diagnostic radiology of the cystic duct (ab), Lidio G. Mosca and Nélida V. Di Rienzo, April, 680
  - intravenous cholangiography and tomography as aid in diagnosis of ascarisiasis of biliary tract (ab), S. Cywes and H. Krige, April, 680
  - intravenous cholangiography with sodium iodipamide: problem of nonvisualization (ab), Martin H. Floch and Abraham Geffen, March, 511
  - intravenous cholecysto-cholangiography in emergency abdominal diagnosis (ab), William G. Meyer, June, 988
  - iodine-containing contrast media and the interference of Teridax for cholangiograms in evaluation of thyroid function by measurement of serum iodine (ab), Evelyn B. Man, Jan., 165
  - oral extrabepatic cholangiography: simple reliable technic, Alex Norman and Mehdi Saghatoslemi, May, 801
  - percutaneous transhepatic cholangiography (ab), Allan A. Kaplan et al, March, 511
  - results obtained with tomographic examination in study of bile ducts with intravenous cholangiography (ab), Clemente Crosta and Pier Alessandro Favero, May, 849
  - technic and evaluation of operative cholangiography (ab), James P. Isaacs and Marvin L. Daves, May, 849
  - the cholangiogram: postmortem study, J. P. Nazareno, E. R. Studenski and J. W. Pickren, Jan., 54
  - the oral cholangiogram (ab), Frank W. Gearing, Jr., and N. M. Canter, Jr., Feb., 327

**BILIARY TRACT**  
See also Bile Ducts; Gallbladder; Liver

**ASCARIASIS**

- intravenous cholangiography and tomography as an aid in diagnosis of ascarisiasis of biliary tract (ab), S. Cywes and H. Krige, April, 680

**CANCER**

- treatment of inoperable cancer of biliary system with radioactive ( $I^{131}$ ) rose bengal (ab), Irving M. Ariel and George T. Pack, Jan., 173

**roentgenography**

- experiences with Duograf (ab), William H. Shehadi, Feb., 330

**BILIGRAFIN.** See Bile Ducts, roentgenography

**BILOPTIN.** See Bile Ducts, roentgenography

**BIOCHEMISTRY**

- biochemical effects of internal irradiation (ab), Charles C. Irving and Jesse D. Perkinson, Jr., June, 996

**BIOLOGY**

- Brookhaven Symposium in Biology, May, 830
- medical electronics and electrical techniques in medicine and biology, combined conferences, June, 978

**BIRCH, ANN MCA., and BAKER, DAVID H.:** Effect of repeated fluoroscopic examinations on 1480 children with a long-term follow-up study (ab), March, 528

**BISHOP, CLIFFORD OTTO.** See BRASLOW, LAWRENCE

**BLACKETT, N. M.** See LAMERTON, L. F.

**BLACKMAN, SYDNEY:** Rotational tomography of the face (ab), May, 840

**BLADDER**

- abnormalities.** See Bladder, obstruction
- cancer**
  - carcinoma of bladder: its treatment by supervoltage x-ray therapy (ab), Robert Morrison, Feb., 341
  - some clinical aspects of megavoltage: bladder carcinoma (ab), R. C. S. Pointon, Feb., 340

**dilatation**

- compression of common iliac vessels by dilatation of bladder; case (ab), Erik Carlsson and Per Garsten, April, 683
- neurogenic.** See Bladder, paralysis

**obstruction**

- congenital bladder neck obstruction: diagnosis by delayed and voiding cystography and surgical removal by use of new cold, crush-cutting punch (ab), Charles M. Stewart, March, 516

**paralysis**

- radiographic findings in neurogenic bladder, Richard M. Friedenberg and Charles Ney, May, 795

**regurgitation from**

- absence of vesicoureteral reflux in normal adult males (ab), Guy W. Lebedetter, Jr., et al, May, 854

**megacystis syndrome (ab), Albert J. Paquin, Jr., et al, March, 516**

**urteric reflux in paraplegic (ab), J. Cosbie Ross et al, March, 515**

**roentgenography.** See other subheads under Bladder

**surgery.** See also Bladder, obstruction

- retrograde ileocystography (ab), Charles J. Staley, June, 990

**tumors**

- eosinophilic granuloma (ab), Edwin W. Brown, March, 522

**BLATZ, HANSON, and EPP, EDWARD R.:** A photographic method of measuring fluoroscopic dose to the patient, Jan., 120

**BLODI, FREDERICK C.:** The effects of experimental x-radiation on the cornea (ab), April, 698

**BLOEDORN, FERNANDO G., and COWLEY, R. ADAMS:** Irradiation and surgery in the treatment of bronchogenic carcinoma (ab), June, 992

**BLONDAL, H., LEVI, I., LATOUR, J. P. A., and FRASER, W. D.:** Observations on the antitumor effect of N-dichloroacetyl-DL-Serine (FT-9045), June, 945

**BLOOD**

- See also Anemia; Erythrocytes; Hemopoietic System; etc. **albumin.** See Blood, proteins
- calcium**
  - middle-lobe atelectasis due to endobronchial sarcoidosis with hypercalcemia and renal impairment (ab), Gerald J. Goldenberg and Richard H. Greenspan, April, 662
- circulation.** See also Brain, blood supply; Embolism; Heart; Spinal Cord; Venae Cavae; etc.
- some aspects of microcirculation of a transplantable experimental tumor, Morton M. Kligerman and Dora K. Henel, May, 810

**enzymes**

- serum enzymes following whole-body radiation in the rabbit (ab), Harry G. Albaum, May, 864

**brain**

- behavior in circulation of radioactive pulmonary embolus and its application to study of fibrinolytic enzymes (ab), Michael Hume et al, Feb., 346

**formation.** See Hemopoietic System

**gamma globulin.** See Gamma Globulin

**iodine**

- effect of diuretics upon serum protein bound iodine and thyroidal uptake of radioactive iodine (ab), David E. Schteingart et al, June, 994
- effects of certain physical and emotional tensions and strains on fluctuations in level of serum protein-bound iodine (ab), Robert Volpé et al, Feb., 342
- iodine-containing contrast media and the interference of Teridax for cholangiograms in evaluation of thyroid function by measurement of serum iodide (ab), Evelyn B. Man, Jan., 165
- iodine metabolism in ectopic thyroid (ab), T. Dorta et al, Jan., 171

**proteins**

- localizing the placenta with radioactive iodinated human serum albumin, Fred C. Heagy and Donald P. Swartz, June, 936
- permeability of cerebral blood vessels in experimental allergic encephalomyelitis studied by radioactive iodinated bovine albumin (ab), M. Vulpe et al, Jan., 173

**thyroglobulin**

- serum "thyroglobulin" in thyroidal carcinoma (ab), Charles A. Owen, Jr., et al, Jan., 172

**BLOOD PRESSURE**

- tonic muscle spasms and blood pressure changes following subarachnoid injection of contrast media. Experimental study in dogs with injection of Kontrast U and mixtures of Kontrast U and Xylocaine (ab), B. Funkquist and N. Obel, April, 687
- high. See also Arteries, pulmonary; Lungs, blood supply; Portal Vein
- clinical evaluation of radioactive Diiodast renogram as screening test in hypertension (ab), Ralph A. Straffon and Antonio M. Garcia, March, 524
- diagnosis and treatment of renal-artery stenosis (ab), J. J. Brown et al, May, 845
- renal vascular hypertension in children (ab), John P. Smith and Mark L. Saylor, May, 846
- surgical treatment of renal hypertension (ab), George C. Morris, Jr., et al, May, 845

**intracardiac**

- “B” lines of Kerley and left atrial size in mitral valve disease: their correlation with mean left atrial pressure as measured by left atrial puncture, R. E. Melham, J. D. Dunbar and R. W. Booth, Jan., 65

**BLOOD VESSELS**

See also Aorta; Arteries; Brain, blood supply; Cardio-vascular System; Capillaries; Veins; etc.  
—unequivocal radiological evidence of intra-uterine fetal death, including demonstration of gas formation within fetal circulation; report of case and review of 37 cases of fetal death (ab), Robert Bennett, May, 854  
—value of peripheral arteriography in assessing acute vascular injuries (ab), William H. Sinkler and Andrew D. Spencer, Jan., 150

**BLUM, JOHN A.** See **BERNSTEIN, EUGENE F.**

**BLUM, LUIS.** See **NATHAN, M. H.**

**BLUTH, IRWIN, and VITALE, PETER:** Right renal enlargements causing alterations in the descending duodenum. A radiographic demonstration, May, 777

**BOAG, J. W.:** Statistical problems which arise in cancer therapy (ab), June, 991

**BOATMAN, JOSEPH B., RABINOVITZ, MARVIN J., and WALSH, JOHN M.:** Effect of salt feeding on thyroid metabolism of  $I^{131}$  in the dog (ab), April, 693

**BOCCACCIO, R., and RIZZO, V.:** Clinical and radiologic considerations on acute occlusions of the small intestine (ab), June, 987

**BOCK, K.** See **HERBST, M.**

**BODY-SECTION ROENTGENOGRAPHY**

—intravenous cholangiography and tomography as an aid in diagnosis of ascarisiasis of biliary tract (ab), S. Cywes and H. Krig, April, 680  
—laminography in follow-up of fractures of odontoid process (ab), Julius Solovay and Gratien B. Brice, Feb., 313  
—nephrotomography: its role in routine urographic studies (ab), Robert M. Lowman and James T. De Luca, Jan., 164  
—results obtained with tomographic examination in study of bile ducts with intravenous cholangiography (ab), Clemente Crosta and Pier Alessandro Favero, May, 849  
—rotational tomography of face (ab), Sydney Blackman, May, 840

—value of tomography in urographic study of infants and children (ab), Cl. Béraud et al., March, 515

**BOGART, FRANKLIN BLEVINS (obit),** May, 831

**BOINEAU, JOHN P.** See **PERKINS, HENRY T., Jr.**

**BOISSET, GERARDO.** See **MOREY, GILBERTO**

**BOULANDE, ROBERT P.** See **TUCKER, ARTHUR S.**

**BONAKDAR-POUR, AKBAR.** See **STAUFFER, HERBERT M.**

**BOND, TOM B.** awarded Gold Medal by Radiological Society of North America, Feb., 299

**BOND, V. P., CRONKITE, E. P., LIPPINCOTT, S. W., and SHELLABARGER, CLAIRE J.:** Studies on radiation-induced mammary gland neoplasia in the rat. III. Relation of the neoplastic response to dose of total-body radiation (ab), May, 862

—See **AMATO, C. G.**

—See **CRONKITE, E. P.**

—See **SHELLABARGER, C. J.**

**BONES**

See also Cranium; Epiphyses; Spine; under names of bones

**atrophy**

—on the incidence of senile osteoporosis (ab), Richmond W. Smith, Jr., et al., April, 681

—osteoporosis in Cushing's syndrome (ab), A. Iannaccone et al., Jan., 159

—radiological diagnosis of osteoporosis: a new approach (ab), Ellis Barnett and B. E. C. Nordin, May, 850

—skeletal changes in burned patients (ab), V. Štepánek and R. Doleček, April, 682

**cancer**

—characteristic bone lesions in post-irradiated carcinoma of the cervix: metastases versus osteonecrosis, Philip Rubin and Dusdee Prabhasawat, May, 703

—osteoblastic bone metastasis in gastrointestinal and bronchial carcinomas (ab), Frances B. Toomey and Benjamin Felson, Feb., 329

—palliation of osseous metastases from breast carcinoma with radioactive phosphorus alone and in combination with adrenalectomy, Joseph P. Storaasli, Richard L. King, Harvey Krieger, William E. Abbott and Hymer L. Friedell, March, 422

**diseases.** See also Bones, pathology; Osteitis; Osteochondritis

—environmental bone disease of hitherto undescribed type (ab), N. F. Dodd et al., May, 850

—skeletal lesions in neurofibromatosis, James C. Hunt and David G. Pugh, Jan., 1

**fractures.** See Fractures; under names of bones

**fragility.** See also Osteosclerosis fragilis

—osteogenesis imperfecta; review of literature with report on 3 cases (ab), A. Awwad and M. Reda, May, 850

**growth**

—influence of x-ray contact therapy of hemangiomas on growing skeleton (ab), Jaromír Kolař and Václav Bek, April, 695

—malformation syndrome in man associated with triploidy (69 chromosomes) (ab), J. A. Book and Berta Santesson, June, 988

—osteogenesis in multiple myeloma; case, Edward C. Porter, March, 457

—vertebral growth and its mechanical control (ab), Robert Roaf, Jan., 158

**marrow**

—acceptance of rat and mouse lung grafts by radiation (bone-marrow) chimeras (ab), George W. Santos et al., April, 702

—autografts of bone marrow in dogs after lethal total-body radiation (ab), John A. Mannick et al., Jan., 178

—effect of homologous bone marrow-spleen cell suspension on survival of swine exposed to radiation from a nuclear weapon (ab), Harry W. Daniell and William H. Crosby, April, 702

—effects of protracted irradiation on blood-forming organs of rat. Part I. Continuous exposure (ab), L. F. Lamer-  
ton et al., March, 528

—experimental hemopoietic replacement: possible use in radiotherapy (ab), Peter Ilbery, April, 691

—hypothermia and ischemia of bone marrow as protection against injury by whole-body x-irradiation in rats (ab), Edgar J. Martin, June, 997

—in vitro leucine incorporation into protein of normal and x-irradiated rabbit bone marrow cells (ab), Edwin M. Uyeki et al., Feb., 349

—marrow embolism and intrasosseous contrast radiography (ab), Hyman L. Gildenhorn et al., April, 684

—multiple myeloma manifested as a problem in diagnosis of pulmonary disease (ab), Edward A. Favis et al., Feb., 317

—osteogenesis in multiple myeloma; case, Edward C. Porter, March, 457

—quantitative studies of bone-marrow cells in early stages of final hemopoietic recovery in irradiated guinea-pigs (ab), P. F. Harris, Feb., 349

—red cell repopulation in irradiated mice treated with plethoric homologous bone marrow (ab), Joan W. Goodman and Ray D. Owen, Feb., 349

—survival of total-body x-irradiated mice after delayed infusions of isologous bone marrow (ab), Isaac Djerassi et al., June, 997

**necrosis**

—characteristic bone lesions in post-irradiated carcinoma of the cervix: metastases versus osteonecrosis, Philip Rubin and Dusdee Prabhasawat, May, 703

**pathology**

—advanced skeletal changes in hyperparathyroidism (ab), Richard M. Friedenberg and Victor Sayegh, Feb., 328

—congenital generalized fibromatosis: case report, with roentgen manifestations, Virgil R. Condore and R. Parker Allen, March, 444

—observations on 100 cases of leukemia in childhood (ab), Reginald Lightwood et al., Feb., 329

—primary hyperparathyroidism (ab), Ching Tseng Teng and M. Herbert Nathan, Feb., 328

—skull in hyperparathyroid bone disease (ab), Kent Ellis and Robert J. Hochstim, Feb., 312

—tuberous sclerosis complex; unusual case of adenoma sebaceum, tuberous sclerosis, and extensive bone lesions (ab), Junji Hasegawa and Royal E. Ihrke, March, 512

**roentgenography.** See also other subheads under Bones

—roentgenologic bone findings after high-voltage injury (ab), J. Kolař and R. Vrabc, Feb., 347

**tumors**

—giant-cell lesions of bone: osteoclastoma and giant-cell tumor variants. Survey of a radiotherapeutic series (ab), J. Walter, March, 519

—lymphangioma of bone, Charles E. Shopfner and R. Parker Allen, March, 449

—malignant mediastinal teratoma with bone metastases: case, Arch W. Templeton, Feb., 215

—osseous localizations of eosinophilic granuloma (ab), Louis Jeannant-Michez, March, 512

—primary hemangiopericytoma of bone: review of literature and report of first case with metastases (ab), Raul A. Marcial-Rojas, Feb., 328

—skeletal metastases from malignant testicular tumors: report of 10 cases with osteolytic and osteoblastic changes (ab), Paul W. Sum et al., Feb., 329

**wounds and injuries**

—radiographic determination of rate of bone healing, George P. Vose, Pauline B. Mack, Sidney O. Brown and Ammon B. Medlen, May, 770

—unrecognized trauma in infants and children (ab), Donald H. Altman and Richard L. Smith, Feb., 327

**BONNET, JOHN D., ORVIS, ALAN L., HAGEDORN, ALBERT B., and OWEN, CHARLES A., Jr.:** Rate of loss of radioiron from mouse and man (ab), March, 326

**BOOK, J. A., and SANTESSON, BERTA:** Malformation syndrome in man associated with triploidy (69 chromosomes) (ab), June, 988

**BOOK REVIEWS**

Balestra, E. Quadri radiologici delle pneumopatie interstiziali idiopatiche e sistemiche nell'adulto, May, 834

Bauer, Donald deForest. Lumbar Discography and Low Back Pain, May, 834

Blewett, J. E., and Rackow, A. M. Anatomy and Physiology for Radiographers, April, 653

Chase, Grafton D. Principles of Radioisotope Methodology, April, 653

Clark, Randolph Lee, Jr., and Cumley, Russell W., editors. The Year Book of Cancer (1959-1960 Year Book Series)

May, 833

## BOOK REVIEWS—cont.

Cronkite, Eugene P., and Bond, Victor P. *Radiation Injury in Man: Its Chemical and Biological Basis, Pathogenesis and Therapy*. Jan., 132

Dargeon, Harold W. *Tumors of Childhood: A Clinical Treatise*. May, 833

Decker, Kurt, editor. *Klinische Neuroradiologie*. March, 488

Etter, Lewis E. *Glossary of Words and Phrases Used in Radiology and Nuclear Medicine Prepared from Various Sources for Medical Secretaries, X-ray Technicians, Medical Students and Residents in Radiology*. April, 652

Felson, Benjamin. *Fundamentals of Chest Roentgenology*. Feb., 807

Fischgold, H., and Gastaut, H., editors. *Rayons X. Radioisotopes et E. E. G. dans l'épilepsie*. June, 980

Francis, G. E., Mulligan, W., and Wormall, A. *Isotopic Tracers: A Theoretical and Practical Manual for Biological Students and Research Workers*. April, 653

Glasser, Otto, editor. *Medical Physics, Volume III*. April, 651

Golden, Ross. *Radiologic Examination of the Small Intestine*. Jan., 132

Hartmann, Edward, and Giles, Evelyn. *Roentgenologic Diagnosis in Ophthalmology*. Feb., 307

Holt, John Floyd, Whitehouse, Walter M., Jaxox, Harold W., and Kligerman, Morton M., editors. *The Year Book of Radiology (1959-1960 Year Book Series, 1960-1961 Year Book Series)*. April, 652

Kirsch, Theodor. *Strahlengefährdung und Strahlenschutz in zahnärztlichen Röntgendiagnostik*. Feb., 308

Les isotopes radioactifs. *Rapports présentés au XXXII<sup>e</sup> Congrès français de médecine, Lausanne, 1959*. April, 654

McLaren, J. W., editor. *Modern Trends in Diagnostic Radiology (Third Series)*. Feb., 308

Mayer, Ernst G. *Diagnose und Differentialdiagnose in der Schädelröntgenologie*. March, 489

Mitchell, J. S. *Studies in Radiotherapy*. April, 652

Morrison, B. H., editor. *Conference on Experimental Cancer Chemotherapy*. Washington, D.C., Nov. 11 and 12, 1959. Jan., 133

Mündrich, Karl, and Frey, Kurt-Walter. *Das Röntgenschichtbild des Ohres. Tomogramm of the Ear*. Feb., 308

Schmidt, Hermann, and Fischer, Erich. *Die okzipitale Dysplasie*. April, 654

Schobinger, Robert A. *Intra-Osseous Venography*. Jan., 133

Shapiro, Robert, and Janzen, Arnold H. *The Normal Skull: A Roentgen Study*. Feb., 306

van der Plaats, G. J. *Medical X-Ray Technique: Principles and Applications*. April, 653

Wolf, Bernard S., Khilnani, Mansha T., and Lautkin, Arthur. *Diagnostic Roentgenology of the Digestive Tract Without Contrast Media: A Mount Sinai Hospital Monograph*. June, 979

BOOKS RECEIVED not reviewed

Abrams, Herbert L., editor. *Angiography*. March, 487

Appleton, G. J., and Krishnamoorthy, P. N. *Safe Handling of Radioisotopes: Health Physics Addendum, Safety Series No. 2*. March, 488

Background Material for the Development of Radiation Protection Standards. Staff Report No. 1. May 13, 1960 of the Federal Radiation Council. Feb., 306

Bentzen, Niels. *Urethrogramic Studies of Prostatic Tuberculosis*. Jan., 132

Bruce, W. R., and Johns, H. E. *The Spectra of X Rays Scattered in Low Atomic Number Materials*. May, 832

Burton, Milton, Kirby-Smith, J. S., and Magee, John L., editors. *Comparative Effects of Radiation*. Jan., 132

Caffey, John. *Pediatric X-Ray Diagnosis: A Textbook for Students and Practitioners of Pediatrics, Surgery & Radiology*. May, 832

Cosslett, V. W., and Nixon, W. C. *X-ray Microscopy*. April, 651

Depth Dose Tables for Use in Radiotherapy. A Survey, Prepared by the Scientific Subcommittee of the Hospital Physicists' Association of Central Axis Depth-Dose Data Measured in Water or Equivalent Media. Brit. J. Radiol. Suppl. No. 10. May, 832

Ecoffier, J. *La radiculographie lombaire dans la sciatique*. Jan., 132

Fields, Theodore, and Seed, Lindon, editors. *Clinical Use of Radioisotopes: A Manual of Techniques*. March, 487

Garland, Joseph, editor. *The Choice of a Medical Career: Essays on the Fields of Medicine*. March, 188

Haftner, E., Ramseyer, M., and Wellauer, J., editors. *Gastro-enterologische Röntgenprobleme. Gallenblase, Gallenwege, Colon. Problèmes gastro-entérologiques et radiologiques: Vésicule biliaire, côlon*. April, 651

Hertrich, F., and Jammet, H. *Safe Handling of Radioisotopes: Medical Addendum Safety Series No. 3*. March, 488

Hollaender, Alexander, editor. *Radiation Protection and Recovery*. April, 651

Infranzi, A., Esposito, G., and di Gaeta, S. *Semeiotica strumentale delle vie biliari*. March, 488

Jeppeson, P. G., and Olin, Tord. *Cerebral Angiography in the Rabbit: An Investigation of Vascular Anatomy and Variation in Circulatory Pattern with Conditions of Injection*. Jan., 132

Johns, Harold Elford. *The Physics of Radiology*. May, 832

Knoefel, Peter K. *Radiopaque Diagnostic Agents*. April, 650

Lamy, Maurice, and Maroteaux, Pierre. *Les Chondrodystrophies génétiques*. May, 833

Lorenz, Werner. *Strahlenschutz in Klinik und ärztlicher Praxis. Ergänzungsband 88. Fortschr. a. d. Geb. d. Röntgenstrahlen*. Feb., 306

Low, Frank H. *Radioisotope Measurement in Nuclear Medicine*. Feb., 306

Miander, Walter. *Dosimetrie der Strahlungen radioaktiver Stoffe*. May, 833

Poppe, Hanno, Lohstotter, Ilse, and Lauwers, Ph. *Technik der Röntgendiagnostik*. Feb., 306

Postlethwait, Raymond W., and Sealy, Will Camp. *Surgery of the Esophagus*. May, 832

Rabinovitch, Reuben. *Diseases of the Intervertebral Disc and its Surrounding Tissues*. June, 979

Radiological Hazards to Patients. Second Report of the Committee, Ministry of Health. Department of Health for Scotland. April, 651

Raven, Ronald W., editor. *Cancer: Progress Volume 1960*. May, 832

Rosati, Louis M., and Lord, Jere W. *Neurovascular Compression Syndromes of the Shoulder Girdle*. April, 650

Routier, D. *Das Röntgenbild des Herzens*. June, 979

Segré, Emilio, editor. *Annual Review of Nuclear Science*. Volume 10, Feb., 306

de Sèze, S., Djian, A., Wellinger, C., and Leroy, J. *L'Arthrose cervicale postérieure (étude anatomo-radiologique) (In French, English, and German)*. April, 651

Selected Papers from the Institute of Cancer Research: Royal Cancer Hospital and from the Royal Marsden Hospital 1958. Jan., 132

Symposium on Mammalian Genetics and Reproduction Given at Research Conference for Biology and Medicine of the Atomic Energy Commission. Sponsored by the Biology Division, Oak Ridge National Laboratory, Oak Ridge, Tenn., April 4-7, 1960. April, 651

Taussig, Helen B. *Congenital Malformations of the Heart*. Volume I. General Considerations. Volume II. Specific Malformations. Feb., 306

The Hazards to Man of Nuclear and Allied Radiations. Second Report to the Medical Research Council. March, 488

Traub, Sidney P. *Roentgenology of Intracranial Meningomas*. June, 979

Veall, N., and Vetter, H. *Radioisotope Techniques in Clinical Research and Diagnosis*. May, 832

Vestby, Gunnar Willer. *Vaso-Seminal Vesiculography in Hypertrophy and Carcinoma of the Prostate with Special Reference to the Ejaculatory Ducts: A Clinical and Experimental Roentgenologic Study*. April, 651

Warren, Shields. *The Pathology of Ionizing Radiation*. June, 979

Warrick, C. K. *Anatomy and Physiology for Radiographers*. May, 832

Weaver, Oscar M., Jr. *Simultaneous Biligraphy: Technic and Interpretation. A Refresher Course Section One: Radiography of the Intact Extrahepatic Biliary Tract*. May, 832

Wellauer, J. *Die Myelographie mit positiven Kontrastmitteln*. Ergänzungsband 89. Fortschr. a. d. Geb. d. Röntgenstrahlen. May, 833

Wuehrmann, Arthur H. *Radiation Protection and Dentistry*. March, 488

BOOTH, C. C.: Malabsorption syndromes: a symposium I Classification of malabsorption syndrome (ab). April, 678

BOOTH, R. W. See MELHEM, R. E.

BORELL, ULF, and FERNSTRÖM, INGEMAR: Radiologic pulmometry (ab). May, 833

BORJA, LILIA LOPEZ, GRAHAM, JOHN B., and DOWD, J. E.: Alteration in glucose tolerance produced by irradiation of the pelvis (ab). Feb., 317

BOUCEK, ROBERT J., MURPHY, WILLIAM P., Jr., and HERNANDEZ, FRANCISCO A.: Intercalitative angiography: cardiovascular spot-filming. April, 515

BOUGHTON, GEOFFREY A. See HARDY, RICHARD W.

BRACHIAL PLEXUS

—importance of cervical myelography in cervical and upper thoracic nerve root avulsion. William J. Varley. March, 376

BRADSHAW, J. See ABBOTT, WILLIAM E.

BRAHMS, S. A. See IANNACCONE, A.

BRAIN

—See also Cerebellum; Meninges; Pituitary Body

abnormalities

—diagnostic approach to infant with an enlarging head (ab). Frederick Murtagh and John A. Kirkpatrick. Jan., 132

blood supply. See also Arteries, cerebral; Brain, tumors

—cerebral angiography in diagnosis of acute stroke (ab). J. W. D. Bull et al. May, 838

—cerebral angiography in rabbit: an investigation of vascular anatomy and variation in circulatory pattern with conditions of injection (ab). P. G. Jeppsson and Tord Olin. May, 839

—cerebral radioangiography (ab). F. Hawliczek et al. Jan., 175

—changes in cerebral circulation of an animal after whole-body ionizing irradiation (ab). R. M. Lyubimova-Gerasimova. Feb., 349

—normal brachial cerebral angiogram (ab). Robert A. Kuhn. June, 984

**BRAIN, blood supply**—*cont.*  
—observer variation in cerebral angiography: an assessment of value of minor angiographic changes in radiologic diagnosis of cerebrovascular disease (ab), J. W. D. Bull et al. Jan., 142  
—permeability of cerebral blood vessels in experimental allergic encephalomyelitis studied by radioactive iodinated bovine albumin (ab), M. Vulpe et al. Jan., 173  
—some radiological aspects of ischemia of brain, A. C. Begg, March, 491  
—vertebral angiography: analysis of 106 cases, Robert Mones, Feb., 230

**calcification**  
—familial idiopathic cerebral calcifications in childhood (ab), Johannes C. Melchior et al. April, 659

**electroencephalography**  
—International Congress on Electroencephalography and Clinical Neurophysiology (Fifth), Feb., 305

**roentgenography**. See also other subheads under Brain  
—appearance of ventricular system twenty-four hours after encephalography: preliminary report (ab), Giovanni Ruggiero and Francesco Salmi, Feb., 312  
—emulsified iodized oil ventriculography (ab), Toshio Matsubara and Takayoshi Nomura, May, 838  
—some remarks on encephalography (ab), Evert Kruyff, June, 983  
—special axial rotation table for pneumoencephalography, Juan M. Taveras, March, 472

**surgery**  
—stereotaxic apparatus for use in cerebral surgery (ab), A. M. Hasting Bennett, April, 687

**tumors**. See also Meninges, tumors  
—calibration studies at medical therapy facility of Massachusetts Institute of Technology (MIT) reactor, Gordon L. Brownell, Charles Porter and Theos J. Thompson, Jan. 124  
—intracranial sarcomas: their roentgenographic manifestations (ab), Hillier L. Baker, Jr., June, 984  
—roentgen diagnosis of intracranial incisural space occupying lesions (ab), Juan M. Taveras, May, 838  
—venous changes in central brain tumors (ab), N. A. Lewtas, March, 493

**BRANDENBURG, ROBERT O.** See DuSHANE, JAMES W.  
—See KINCAID, OWINGS W.

**BRASLOW, LAWRENCE, BISHOP, CLIFFORD OTTO, and BURCH, BURFORD T.** Strangulated diaphragmatic hernia complicated by gangrene of the stomach (ab), Feb., 322

**BRAT, VED.** See ERSHOFF, BENJAMIN H.

**BRAUER, EARL W., KOOP, ALFRED W., WITTEN, VICTOR H., BERMAN, MONES, and CAVE, VERNAL G.** Radioactive phosphorus in the in vivo diagnosis of melanoma of the skin (ab), Feb., 344

**BRAND, ERNEST J.** See FLETCHER, GILBERT H.

**BRANWALD, EUGENE.** See LONG, ROBERT T. L.  
—See BREAST

**cancer.** See also Tumors, in animals  
—beta-treatment of gynecologic cancers (ab), Gerhard Schubert et al. March, 520  
—cancer of breast: radiation therapy of carcinoma of breast supplementing surgery (ab), Galen M. Tice, Feb., 337  
—cause and treatment of edema of arm following radical mastectomy (ab), Magnus I. Smedal and James A. Evans, May, 856  
—irradiation pneumonitis in treatment of carcinoma of breast (ab), M. N. Lougheed and G. H. Maguire, Feb., 346  
—management of early breast cancer (ab), T. H. Ackland et al. March, 519  
—palliation of osseous metastases from breast carcinoma with radioactive phosphorus alone and in combination with adrenalectomy, John P. Storaasli, Richard L. King, Harvey Krieger, William E. Abbott and Hymer L. Friedell, March, 422  
—value of an early change in hormonal status through suspension of ovarian function and application of androgens in therapy of advanced mammary carcinoma: experiences with prophylactic x-ray castration in 284 patients (ab), Hanno Poppe and Anton Gregg, March, 519

**BRENE, NIELS.** See KAAE, SIGVARD

**BRENT, LAWRENCE B., ABURANO, AKIO, FISHER, DON L., MORAN, THOMAS J., MYERS, JACK D., and TAYLOR, W. JAPE.** Familial muscular subaortic stenosis. An unrecognized form of "idiopathic heart disease," with clinical and autopsy observations (ab), Feb., 318

**BRENT, ROBERT L.** The indirect effect of irradiation on embryonic development. II. Irradiation of the placenta (ab), May, 864  
—and McLAUGHLIN, MARY M.: The indirect effect of irradiation on embryonic development. I. Irradiation of the mother while shielding the embryonic site (ab), May, 863

**BRESLAW, LEONARD.** Malignant disease and gastric polyps (ab), April, 676

**BRESSIEUX, R.** See BÉRAUD, CL.

**BRETTELL, HERBERT R., AIKAWA, JERRY K., and GORDON, GERALD S.** Studies with chlorothiazide tagged with radioactive carbon ( $C^{14}$ ) in human beings (ab), May, 858

**BRICE, GRATIEN B.** See SOLOVAY, JULIUS

**BRILL, A. BERTRAND.** See HEYSEL, ROBERT

**BROAD LIGAMENT**  
—varicocele of broad ligament: a venographic study (ab), C. G. Helander and Å. Lindblom, Jan., 163

**BROCHER, J. E. W., and KLEIN, D.** Mandibulofacial dysostosis on the roentgen film (ab), May, 840

**BROCK, JOSEPH W.** See SLOAN, ROBERT D.

**BRODEUR, ARMAND E.** Experiences with oral and rectal contrast media in pediatric radiology (ab), April, 675

**BRODSKY, LEONARD.** See KAPLAN, ALLAN A.

**BRODY, EUGENE A., ESTREN, SOLOMON, and WASSERMAN, LOUIS R.** The kinetics of intravenously injected radioactive vitamin  $B_{12}$ : studies on normal subjects and patients with chronic myelocytic leukemia and pernicious anemia (ab), June, 995

**BRONCHI**  
See also Bronchiectasis  
—bronchial wall thickening in asthma (ab), C. J. Hodson and S. E. Trickey, May, 842  
—lengths of the two main bronchi and angle at the carina: preliminary study (ab), G. A. Kher and J. S. Makhani, Feb., 318

**cancer.** See Lungs, cancer  
—diseases  
—middle-lobe atelectasis due to endobronchial sarcoidosis, with hypercalcemia and renal impairment (ab), Gerald J. Goldenberg and Richard H. Greenspan, April, 662

**foreign bodies.** See Foreign Bodies. in air and food passages

**roentgenography**  
—bronchography: a neglected investigation? (ab), W. G. Smith et al. May, 842

—bronchography using dyclone hydrochloride anesthesia (4% N-Butoxy-beta-piperidino-propiphenone-hydrochloride) (Dyclone) (ab), David E. Wheeler, Jan., 146

—percutaneous cricothyroid membrane bronchography, Samuel D. Hemley, Edward J. Arida, A. Monroe Diggs and Sumner L. Freeman, May, 763. See also correction, June, 980

**rupture**  
—x-ray diagnosis of hydatid cyst of lung: its rupture into bronchus and spontaneous healing (ab), R. Venkateswara Rao, March, 499

**structure**  
—expiratory stenosis of trachea and main stem bronchi due to weakened pars membranacea: its treatment by plastic reinforcement (ab), H. Herzog, Jan., 146

**wounds and injuries**  
—injuries of trachea and major bronchi (ab), R. Maurice Hood and Herbert E. Sloan, Feb., 314

**BRONCHIECTASIS**  
—gamma globulin concentrations in ambulatory patients with bronchiectasis: survey with report of 1 case of agammaglobulinemia treated for four years (ab), Helen S. Pittman, March, 501

**BRONCHOGRAPHY.** See Bronchi, roentgenography, Tuberculosis, Pulmonary

**BRONSTEIN, EUGENE.** See CLIFFTON, EUGENE E.

**BROOKHAVEN SYMPOSIUM IN BIOLOGY**, May, 830

**BROTHER, RUTH A.** See BAILY, NORMAN A.

**BROWN, CHARLES H.** Carcinoma of the pylorus simulating benign duodenal obstruction (ab), Feb., 323

**BROWN, EDWIN W.** Eosinophilic granuloma of the bladder (ab), March, 522

**BROWN, FRANK A.** See ALLEN, RALPH G.

**BROWN, J. J., OWEN, K., PEART, W. S., ROBERTSON, J. L. S., and SUTTON D.** The diagnosis and treatment of renal-artery stenosis (ab), May, 845

**BROWN, SAMUEL** (obit). April, 647

**BROWN, SIDNEY O.** See VOSE, GEORGE P.

**BROWNELL, GORDON L., PORTER, CHARLES, and THOMPSON, THEOS J.** Calibration studies at medical therapy facility of Massachusetts Institute of Technology (MIT) reactor, Jan., 124

**BRÜNNER, S., GAMMELGÅRD, P. A., PETERSEN, OLAF, and STÖRM, O.** Arterial malformation in the superior mediastinum (ab), Jan., 148

—and POCK-STEEN, O. CH.: Localized emphysema (ab), Jan., 144

**BRUES, ALICE M.** See CHRISTENSEN, JOHN B.

**BRUMMER, PEKKA, and HÄKKINEN, ILKKA.** X-ray negative dyspepsia. A follow-up study (ab), Jan., 153

**BRUNST, V. V.** Reaction of limb regenerates of adult axolotl (*Siretron mexicanum*) to x-irradiation (ab), June, 998

**BRUNTON, F. J.** Retroperitoneal emphysema as a complication of barium enema (ab), May, 849

**BRUSH, BROCK E.** See PONKA, JOSEPH L.

**BRUWER, ANDRÉ J.** See BERKSON, JOSEPH  
—See HODGSON, CORRIN H.

**BUILDING MATERIALS.** See Concrete; etc.

**BULBULIAN, ARTHUR H.** See HODGSON, CORRIN H.

**BULL, J. W. D., COUCH, R. S. C., JOYCE, DAPHNE, MARSHALL, J., POTTS, D. G., and SHAW, D. A.** Observer variation in cerebral angiography: an assessment of the value of minor angiographic changes in the radiological diagnosis of cerebrovascular disease (ab), Jan., 142

—MARSHALL, JOHN, and SHAW, D. A.: Cerebral angiography in the diagnosis of the acute stroke (ab), May, 838

**BULLET WOUNDS.** See Cardiovascular System, foreign bodies

**BURCH, BURFORD T.** See BRASLOW, LAWRENCE

**BURKE, B. A.** See FEINBERG, S. B.

BURNETT, W., MACFARLANE, P. S., PARK, S. D., SCOTT, and KAY, A. W.: Carcinoma of the stomach: an evaluation of diagnostic methods including exfoliative cytology (ab), Feb., 321

**BURNS**  
—skeletal changes in burned patients (ab), V. Štepánek and R. Doleček, April, 682

**BURNS, J. E.** See COHEN, M.

**BURNS, THOMAS W., VICKERS, RAYMOND, and LOWNEY, JOHN F.**: Acute leukemia after radioactive iodine ( $^{131}\text{I}$ ) therapy for hyperthyroidism (ab), May, 862

**BURWELL, JAMES A.** See PERRYMAN, C. RICHARD

**BUSCH, G.** See MEYER, H.-ST.

**BUTLER, NEVILLE** See LIGHTWOOD, REGINALD

**BUTOXYPiperidinopropiophenone (Dyclonine).** See Bronchi, roentgenography

**BUTTENBERG, DIETRICH**: Adenocarcinoma of the uterine cervix (ab), March, 520

**BUTTERFLY VERTEBRA.** See Spine, abnormalities

**C**

**CAHILL, JOHN J.** See ZEIT, PAUL R.

**CALCIFICATION.** See Adrenals; Aorta; Arteries, gastric; Brain; Lymph Nodes; Stomach, cancer; Vas Deferens; etc.

**CALCIUM.** See Blood, calcium

**CALCULI.** See Appendix; Gallbladder; Veins

**CALLAHAN, JOHN A.** See HODGSON, CORIN H.

**CALLE, R.** See BACLESSE, F.

**CALLENDER, SHEILA T.** See BADENOCH, JOHN

**CALVERT, WILLIAM P.** See TUDDENHAM, WILLIAM J.

**CAMPBELL, JAMES B., AND HUDSON, FRANK M.**: Cranio-buccal origin, signs, and treatment of craniopharyngiomas (ab), June, 991

**CAMPBELL, JOHN A., AND KLATTE, EUGENE C.**: Radiology of patent ductus arteriosus (ab), Jan., 147

—See GWYN, JOHN L.

**KLATTE, EUGENE C., GRAY, DONALD D., AND McCREA, ALICE L.**: Evaluation of film size in cineradiography, April, 606

**CAMPBELL, PAUL A.**: Medical aspects of ambient radiations of extraterrestrial space (ab), Jan., 178

**CANADA, ROBERT O.** See WELCH, C. CHARLES

**CANCER.** See also Sarcoma; under organs and regions  
—American Cancer Society Scientific Session, June, 979  
—International Cancer Congress (Eighth), June, 978  
—international cancer fellowships, May, 830  
chorionic  
—iodine metabolism in hydatid mole and choriocarcinoma (ab), J. Thomas Dowling et al., Jan., 173  
—pulmonary metastasis from trophoblastic tumors, Lloyd K. Mark and Morris Moel, April, 601  
—roentgenologic manifestations of trophoblastic tumors (ab), Theodore F. Hilbush and Emil Schulz, Jan., 162  
etiology. See Cancer, in children and young adults  
in children and young adults  
—carcinoma of thyroid gland in childhood: its relation to radiotherapy (ab), Russell Howard, March, 527  
—role of x-ray therapy to neck region in production of thyroid cancer in young people: 37 cases (ab), E. Hunter Wilson and Samuel P. Asper, Jr., April, 600  
metastases. See also Bones, cancer; Cancer, chorionic; Lungs, cancer; Lymph Nodes, cancer  
—late involvement of alimentary tract by carcinoma of kidney (ab), Mansho T. Kbiliani and Bernard S. Wolf, April, 679  
—metastatic cancer of the neck (ab), Zolito Marinello, Jan., 165  
—ureteral metastasis from renal adenocarcinoma presenting a bizarre urogram (ab), James W. Sargent, Jan., 163  
radiotherapy  
—application of television in supervoltage therapy (ab), F. K. Baum and H. Kuttig, Feb., 341  
—initial clinical reaction to therapeutic whole-body roentgen radiation: some civil defense considerations (ab), William C. Levin et al., Jan., 177  
—place of radiation therapy in treatment of cancer (ab), R. Kenneth Loeffler, March, 517  
—quantitative measurements of oxygen tension in normal tissues and in tumors of patients before and after radiotherapy (ab), Donald B. Cater and Ian A. Silver, Jan., 177  
—Teflon tube method of radium implantation (ab), Oscar L. Morphis, Jan., 170  
therapy. See also Cancer, radiotherapy  
—measurement of value of treatment in malignant disease (ab), Robert McWhirter, June, 991  
—observations on the antitumor effect of N-dichloroacetyl-DL-serine (PT-9045), H. Blondal, I. Levi, J. P. A. Latour and W. D. Fraser, June, 945  
—statistical problems which arise in cancer therapy (ab), J. W. Bogg, June, 991

**CANTER, N. M., Jr.** See GEARING, FRANK W., Jr.

**CAPILLARIES**  
—fatal embolization of pulmonary capillaries: report of case associated with routine barium enema (ab), Keith M. Truemmer et al., May, 848

—radiologic considerations of the perinatal distress syndrome, Edward B. Singleton, Harvey M. Rosenberg and Luis Samper, Feb., 200

**CAPITATE BONE.** See Wrist

**CARBON.** See Radioactivity, radiocarbon

**CARBON DIOXIDE**  
—gas and opaque contrast in roentgenographic diagnosis of pericardial disease (ab), Herbert M. Stauffer et al., Jan., 148

—pneumopelvigraphy of developmental malformations of the female internal genitalia (ab), M. Henzl et al., Jan., 162

**CARCINOID.** See Gastrointestinal Tract, cancer; Intestines, cancer; Lungs, cancer

**CARDIA.** See Stomach

**CARDIOANGIOGRAPHY.** See Cardiovascular System

**CARDIOVASCULAR SYSTEM**  
See also Aneurysm; Aorta; Heart; etc.  
abnormalities  
—misleading thoracic roentgenograms: cardiovascular abnormalities that may simulate diseases of lungs, body thorax, or mediastinum (ab), Corrin H. Hodgson et al., April, 663

**foreign bodies**  
—localization of bullets and metallic fragments in cardiovascular system: role of angiography in 7 cases (ab), Israel Steinberg, April, 664

**roentgenography.** See also Aneurysm; Aorta; Heart; abnormalities  
—Ditriokon: a new cardiovascular contrast agent, Israel Steinberg, Nathaniel Finby and John A. Evans, Jan., 96

—evaluation of cardiovascular contrast media, J. Stauffer Lehman and Joseph N. Debbas, April, 548

—experiences with angiography as guide to mediastinal exploration (ab), Owings W. Kincaid et al., April, 669

—intercalative angiography: cardiovascular spot-filming, Robert J. Boucek, William P. Murphy, Jr., and Francisco A. Hernandez, April, 565

—left retrograde cardioangiography: its diagnostic value in acquired and congenital heart disease, Kurt Amplatz, Richard G. Lester, Richard Ernst and C. Walton Lillehei, March, 393

—lipoid pneumonia associated with paraesophageal hernia: angiographic study of case (ab), Israel Steinberg, Jan., 145

—potassium iodide screens and high-capacity roentgen tubes in angiography (ab), Erik Carlsson, April, 669

—some aspects of cine- and high-speed serial angiographic techniques (ab), Theodore E. Keats et al., April, 668

—stenosis of right main pulmonary artery. Clinical angiographic and catheterization findings in 10 patients (ab), Lawrence L. Luan et al., May, 844

—syringe heater for angiography, Lester L. Vargas and Thomas Forsythe, Feb., 248

**CARLSON, CURTIS H., ARMSTRONG, W. D., SINGER, LEON, AND HINSHAW, LERNER B.**: Renal excretion of radiofluoride in the dog (ab), March, 526

**CARLSSON, ERIK.** See Potassium iodide screens and high capacity roentgen tubes in angiography (ab), April, 669

—AND GARSTEN, PER: Compression of the common iliac vessels by dilatation of the bladder. Report of a case (ab), April, 685

**CARMAN LECTURE.** See Radiological Society of North America

**CARR, DAVID T.** See BERKSON, JOSEPH

**CARR, EDWARD A., Jr.** See FLOYD, JOHN C., Jr.

**CARRAS, ROBERT** and **FRIEDENBERG, MARVIN J.**: A clinical and radiographic study of appendiceal fealiths: a review of the literature and report of seven cases (ab), Feb., 325

**CARRUTHERS, J. A.** See WILSON, R.

**CARTER, BARBARA L.** See STAUFFER, HERBERT M.

**CARTIER, G. E.** See PIGEON, G.

**CARTILAGE**  
See also Joints; Osteochondritis  
—estradiol reduces incorporation of radioactive sulfate into cartilage and aortas of rats (ab), Robert E. Priest et al., May, 861

**CARVALHO, EVELYN.** See DeGROOT, LESLIE J.

**CASTRATION**  
See also Ovary, effects of irradiation  
—studies on radiation-induced mammary gland neoplasia in rat. II. The response of castrate and intact male rats to 400 r of total-body irradiation (ab), C. J. Shellabarger et al., April, 701

**CATER, DONALD B., AND SILVER, IAN A.**: Quantitative measurements of oxygen tension in normal tissues and in the tumours of patients before and after radiotherapy (ab), Jan., 177

**CATHARTICS**  
—preparation of colon with new senna compound (Roenten), Charles W. Reavis, Thomas S. Long, Willis E. Lemon and Lawrence R. Nickell, April, 642

**CATHCART, RICHARD T.** See FRAIMOW, WILLIAM

**CATHETERS AND CATHETERIZATION**  
See also Arteries, roentgenography; Heart, catheterization  
—coronary arteriography. I. Differential opacification of aortic stream by catheters of special design—experimental development (ab), Sven Belhamn et al., Jan., 149

—coronary arteriography. II. Clinical experiences with the loop-end catheter (ab), John A. Williams et al., Jan., 150

**CATT, B.** See ODDIE, T. H.

**CATTANEO, S. M., QUASTLER, H., AND SHERMAN, F. G.**: DNA synthesis in irradiated hair follicles of the mouse (ab), June, 997

**CATTERALL, MARY:** The effect of radiation upon the heart (ab), Jan., 176

**—AND EVANS, WILLIAM:** Myocardial injury from therapeutic irradiation (ab), April, 696

**CAVE, VERNAL G.** See **BRAUER, EARL W.**

**CAVOGRAPHY.** See **Venae Cavae**

**CAWEIN, MADISON J., III, HAGEDORN, ALBERT B., and OWEN, CHARLES A., Jr.:** Anemia of hepatic disease studied with radiochromium (ab), Feb., 345

**CECCHINI, A.:** The radiologic appearance of acoustic neuroma: a review of 68 cases (ab), March, 493

**CECUM**

—diverticulitis of cecum and ascending colon (ab), Virgil C. Daniel and Ernest H. Wood, Jan., 156

—roentgen examination of cecum and proximal ascending colon with ingested barium, E. Robert Heitzman and Alfred S. Berne, March, 415

**CELIAIC DISEASE**

—effect of corticosteroids and gluten-free diet on absorption of iron in idiopathic steatorrhea and celiac disease (ab), John Badenoch and Sheila T. Callender, June, 994

**CELLS**

See also **Eosinophils; Erythrocytes; Stomach, cancer; Tissue; Uterus, cancer; etc.**

**CEREBELLUM**

—radiation effects of neutron-capture therapy on a malignant vascular neoplasm of cerebellum: histopathologic observations (ab), Stuart W. Lippincott et al., March, 517

—vertebral arteriography of benign tumors (ab), A. Isfort, April, 660

**CEREBRUM. See Brain**

**CESIUM.** See **Radioactivity, radiocesium**

**CHAIKOFF, I. L. See POTTER, G. D.**

**CHAN, PAUL Y. M., and LIEBNER, EDWIN J.:** In vitro effects of irradiation combined with actinomycin D, Feb., 273

**CHANDLER, E. F. See WOOLFREY, B. F.**

**CHATTERJEE, J. B. See GHOSE, SANDHYA**

**CHEITLIN, MELVIN D., BERNSTEIN, ROBERT, and LANGDON, EDWARD A.:** Varying responses to radioactive iodine ( $^{131}\text{I}$ ) therapy in hyperthyroid patients (ab), Feb., 343

**CHELAZZI, M. See AMBESI IMPIOMBATO, G.**

**CHEMICALS AND CHEMOTHERAPY**

See also under names of diseases and chemotherapeutic agents, as AET

—observations on the antitumor effect of N-dichloroacetyl-DL-serine (FT-9045), H. Blondal, I. Levi, J. P. A. Latour and W. D. Fraser, June, 945

—shortening of life span of mice by irradiation with x-rays and treatment with radiomimetic chemicals (ab), Peter Alexander and Dorothea I. Connell, April, 700

**CHEST. See Thorax**

**CHILDREN**

See also **Bones, growth; Cancer, in children and young adults; Kidneys, tumors; Peptic Ulcer, in children; Pneumonia, in children**

—acute pyogenic infections of spine in children (ab), A. E. Pritchard and W. A. L. Thompson, Jan., 159

—adenoma of parathyroid gland in children; report of case and brief review of literature (ab), Robert B. Nolan et al., April, 659

—automatic device for voiding urethrogram (P-O-mat) in infants and small children, J. Scott Dunbar, Richard B. Goldblum, Victor Pollock and Rex Radford, March, 467

—chondrodstrophy congenita punctata (Conradi's disease); review of literature and report of case with unusual features (ab), Mathew Allansmith and Edward Senz, May, 851

—congenital generalized fibromatosis; case report, with roentgen manifestations, Virgil R. Condon and R. Parker Allen, March, 444

—diagnostic approach to infant with enlarging head (ab), Frederick Murtagh and John A. Kirkpatrick, Jan., 142

—effect of repeated fluoroscopic examinations on 1,480 children with a long-term follow-up study (ab), Ann McA. Birch and David H. Baker, March, 528

—experiences with oral and rectal contrast media in pediatric radiology (ab), Armand E. Brodeur, April, 675

—familial idiopathic cerebral calcifications in childhood (ab), Johannes C. Melchior et al., April, 659

—gonadal dosage in pediatric radiotherapy, John L. Gwinn, David C. Gastineau and John A. Campbell, June, 881

—observations on 106 cases of leukemia in childhood (ab), Reginald Lightwood et al., Feb., 329

—renal vascular hypertension in children (ab), John P. Smith and Mark L. Saylor, May, 846

—Salmonella osteitis in Nigerian children (ab), R. G. Hendricks and Patrick Collard, May, 851

—unrecognized trauma in infants and children (ab), Donald H. Altman and Richard L. Smith, Feb., 327

—value of tomography in urographic study of infants and children (ab), Cl. Béraud et al., March, 515

**CHILD, DONALD S., Jr. See OWEN, CHARLES A., Jr.**

**CHILKO, ALEXANDER J.:** Contribution to the problem of diagnosis, treatment and prognosis of Wilms tumor (ab), April, 691

**CHIMERAS.** See **Roentgen Rays, effects**

**Di CHIRO, GIOVANNI:** The width (third dimension) of the sella turcica (ab), June, 983

**CHLOROTHIAZIDE.** See **Diuretics**

**CHOLANGIOGRAPHY.** See **Bile Ducts, roentgenography**

**CHOLECYSTECTOMY.** See **Gallbladder, excision**

**CHOLECYSTOGRAPHY.** See **Gallbladder, roentgenography**

**CHOLECYSTOKININ**

—gallbladder evacuation in normal male induced by cholecystokinin (ab), Paul Edholm, Feb., 326

**CHOLEDOCHUS:** See **Bile Ducts**

**CHONDRODYSTROPHIA CONGENITA PUNCTATA.** See **Achondroplasia**

**CHORIOCARCINOMA.** See **Cancer, chorionic**

**CHOROID**

— $\text{P}^{32}$  localization of malignant melanoma of posterior choroid (ab), J. O'Rourke and Eleanor Collins, April, 694

**CHOVINICK, STANLEY D., AND NEWMAN, HARRY R.:** Management of renal injuries (ab), Feb., 333

**CHRISTENSEN, JOHN B., LACHMAN, ERNEST, and BRUES, ALICE M.:** A study of the roentgen appearance of cranial vault sutures: correlation with anatomy (ab), Feb., 313

**CHRISTIAN, E. J. See STEARNER, S. P.**

**CHRISTOFORIDIS, ANTHIMOS J., and MOLNAR, WILLIAM:** Eosinophilic pneumonia. Report of two cases with pulmonary biopsy (ab), March, 498

**CHROMIUM.** See **Radioactivity, radiochromium**

**CHROMOSOMES**

—malformation syndrome in man associated with triploidy (69 chromosomes) (ab), J. A. Book and Berta Santesson, June, 988

**CIMMINO, CHRISTIAN V. See WYMAN, ALVIN C.**

**CINDER BLOCK**

—conventional building materials as protective radiation barriers, E. Dale Trout, John P. Kelley and Arthur C. Lucas, Feb., 237

**CINECHOLEDOCHOGRAPHY.** See **Cineroentgenography**

**CINEFLUOROGRAPHY.** See **Cineroentgenography**

**CINEROENTGENOGRAPHY**

—brief massive spasm of distal esophagus greatly increasing gastric herniation, documented cineradiographically in patient with lower esophageal ring (ab), Herbert M. Stauffer et al., Feb., 320

—cinecholedochography, Stevens S. Sanderson and Kenneth E. Gross, Feb., 267

—cineurography (ab), Robert A. Garrett and Eugene C. Klatte, Feb., 332

—endoscopic operation for hypopharyngeal diverticula: a roentgen cinematographic study (ab), Gösta Dohlman and Ove Mattsson, March, 494

—evaluation of film size in cineradiography, John A. Campbell, Eugene C. Klatte, Donald D. Gray and Alice L. McCrea, April, 606

—large field cineradiography and image intensification utilizing the TVX system, Joseph H. Weiss, Feb., 264

—motility changes revealing esophagogastric junction, Majie S. Potsaid, Goro Irie and Nathan T. Griscom, Feb., 262

—some aspects of cine- and high-speed serial angiographic techniques (ab), Theodore E. Keats et al., April, 668

—University of Rochester, Third Cinefluorography Symposium, May, 830

—use of cinefluorography in routine diagnosis of disease of upper gastrointestinal tract; experience in 1,000 cases (ab), Joseph Jorgens et al., April, 675

**CINEUROGRAPHY.** See **Cineroentgenography**

**CIRCULATION.** See **Blood, circulation; Brain, blood supply; Embolism; Heart; Spinal Cord; Venae Cavae; etc.**

**CIVIL DEFENSE.** See **Atomic Bomb and Atomic Energy**

**CLARK, ROBERT T., Jr. See ELLIS, JAMES P., Jr.**

**CLAYPOOL, HARRY A. See McTAGGART, WESLEY G.**

**CLAYTON, G. See FIELDS, T.**

**CLIFFTON, EUGENE E., GOÖDNER, JOHN T., and BRONSTEIN, EUGENE:** Preoperative irradiation for cancer of the esophagus (ab), April, 689

**CLOSE, HENRY P. See RODMAN, THEODORE**

**COBALT.** See **Radioactivity, radiocobalt**

**COHAN, BRUCE E.:** Experimental intraocular venography (ab), April, 671

**COHEN, BERNARD R. See WOLF, BERNARD S.**

**COHEN, G. A. See SCHULZ, R. J.**

**COHEN, GEORGE, and KATZ, JOSEPH:** The importance of radiographic examination of the oesophagus and routine chest radiography after oesophagoscopy (ab), Feb., 320

**COHEN, M., BURNS, J. E., and SEAR, R.:** Physical aspects of cobalt 60 teletherapy using wedge filters. I. Physical investigations. II. Dosimetric considerations (ab), March, 525

**COHEN, SUMNER S. See TSAI, S. H.**

**COITUS**

—x-irradiation lethality aggravated by sexual activity of male mice (ab), Roberts Rugh and Erica Grupp, April, 701

**COLD**

—hypothermia and ischemia of bone marrow as protection against injury by whole-body x-irradiation in rats (ab), Edgar J. Martin, June, 997

**COLE, LEONARD J., and GARVER, RICHARD M.:** Studies on the mechanism of secondary disease. The parental-F<sub>1</sub> hybrid radiation chimera (ab), May, 864

**—NOWELL, P. C., and ARNOLD, J. S.:** Late effects of x-radiation. The influence of dose fractionation on life span, leukemia, and nephrosclerosis incidence in mice (ab), May, 862

—See **SANTOS, GEORGE W.**

**COLE, WARREN H.**: awarded Gold Medal by Radiological Society of North America, Feb., 299

**COLE, WARREN H.**: Historical features of cholecystography; the Carman lecture, March, 354

**COLITIS**  
ulcerative  
—carcinoma complicating chronic ulcerative colitis (ab), Leah S. Finkelstein et al, Feb., 324  
—frequency of polyps of colon in ulcerative colitis (ab), L. Andrén and S. Welin, March, 508  
—toxic dilation of colon in course of ulcerative colitis (ab), R. H. Marshak et al, Jan., 155

**COLLARD, PATRICK**. See **HENDRICKSE, R. G.**

**COLLICA, CARE**. See **KAPLAN, GUSTAVE**

**COLLINS, ELEANOR**. See **O'ROURKE, J.**

**COLLINS, VINCENT P.** See **McTAGGART, WESLEY G.**

**COLON**  
See also **Colitis**; **Intestine**; **Gastrointestinal Tract**; **Sigmoid**  
**abnormalities**  
—duodenocolic apposition (ab), M. H. Poppel, March, 507  
**cancer**  
—carcinoma complicating chronic ulcerative colitis (ab), Leah S. Finkelstein et al, Feb., 324  
**dilatation**  
—adult megacolon without obstruction (ab), Myron Melamed et al, May, 848  
—toxic dilation of colon in course of ulcerative colitis (ab), R. H. Marshak et al, Jan., 155  
**diverticula**. See **Intestines, diverticula**; **Sigmoid, diverticula**  
 **fistula**. See **Fistula**  
**infarction**  
—infarction of descending colon due to vascular occlusion; 3 cases (ab), James J. McCort, Jan., 155  
**roentgenography**. See also **Intestines, roentgenography**  
—preparation of colon with new senna compound (Roenten), Charles W. Reavis, Thomas S. Long, Willis E. Lemon and Lawrence R. Nickell, April, 642  
—roentgen examination of cecum and proximal ascending colon with ingested barium, E. Robert Heitzman and Alfred S. Berne, March, 415  
**tumors**  
—frequency of polyps of colon in ulcerative colitis (ab), L. Andrén and S. Welin, March, 508  
**volvulus**. See **Intestines, volvulus**

**COMPERE, W. E., Jr.**: The radiologic evaluation of eustachian tube function (ab), March, 495

**Radiologic findings in otosclerosis (ab)**, March, 495

**COMPUTERS**  
—calculation of isodos distributions in interstitial implants by a computer, Robert J. Shalek and Marilyn A. Stoval, Jan., 119

**CONCRETE**  
—conventional building materials as protective radiation barriers, E. Dale Trout, John P. Kelley and Arthur C. Lucas, Feb., 237

**CONDON, VIRGIL R.** and **ALLEN, R. PARKER**: Congenital generalized fibromatosis. Case report, with roentgen manifestations, March, 444

**CONNECTIVE TISSUE**  
—congenital generalized fibromatosis; case report, with roentgen manifestations, Virgil R. Condon and R. Parker Allen, March, 444

**CONNELL, DOROTHEA I.** See **ALEXANDER, PETER**

**CONRADI'S DISEASE**. See **Achondroplasia**

**CONTRAST MEDIA**. See **Abdomen, acute conditions**; **Cardiovascular System**, **roentgenography**; **Gallbladder, roentgenography**; **Gastrointestinal Tract**, **obstruction**; **Intestines, roentgenography**; **Iodine and Iodine Compounds**; **Pyelography**; etc.

**COOLEY, DENTON A.** See **MORRIS, GEORGE C., Jr.**

**COPENHAVER, W. M.**, **VAN DYKE, RHODA H.**, and **RUGH, ROBERTS**: Effects of x-irradiation on embryos at critical stages of heart development (ab), April, 699

**CORACOID PROCESS**. See **Scapula**

**CORDAY, ELIOT**, and **JAFFE, HENRY**: Routine cardiac fluoroscopy—an unnecessary health hazard (ab), Jan., 176

**CORMACK, D. V.**: A comparison of theoretical and experimental spectral distributions of scattered x-rays (ab), May, 857

**CORNEA**  
—effects of experimental x-irradiation on cornea (ab), Frederick C. Blodi, April, 698

**CORONARY VESSELS**  
—angiographic findings in coronary sclerosis (ab), L. Di Guglielmo, Feb., 319  
—coronary arteriography. I. Differential opacification of aortic stream by catheters of special design—experimental development (ab), Sven Bellman et al, Jan., 149  
—coronary arteriography. II. Clinical experiences with the loop-end catheter (ab), John A. Williams et al, Jan., 150  
—coronary arteriography in selection of patients for surgery, Erich K. Lang and David C. Sabiston, Jr., Jan., 32  
—coronary arteriovenous fistula into main pulmonary artery: preoperative diagnosis by selective aortography (ab), Kurt Amplatz et al, Feb., 319  
—roentgen investigation of coronary veins in dog (ab), L. di Guglielmo et al, Jan., 150

—roentgenographic demonstration of coronary arteries (ab), Gunnar Jonsson and Lars Hellström, Feb., 319

**CORTICOSTEROID THERAPY**. See **Adrenocortical Preparations**

**COTTAFAVI, M.** and **MENTASTI, P.**: Amniotic circulation studied with  $^{131}\text{I}$  (ab), March, 525

**COUCH, R. S. C.** See **BULL, J. W. D.**

**COUNTERS AND COUNTING**  
—continuous monitored dialysis-perfusion device for study of two compartment systems, Ervin Kaplan and John J. Iamariso, Jan., 123

—hepatography and study of liver function by means of  $^{131}\text{I}$ -tagged rose bengal (ab), D. Zillotti, March, 524

—method and parameters for the analysis of renal function by external scintillation detector technic, Richard L. Witowski, Joseph E. Whitley, I. Meschan and William E. Painter, April, 621

—new simple radiation scanning system, T. Fields, G. Clayton and J. Kensi, Jan., 122

—radioisotope concentration gradient analyzer—design and application, Rosalyn S. Yalow and Solomon A. Berson, Jan., 123

—solid-state and proportional beta detectors for use in vitro, C. V. Robinson, March, 479

—technical considerations in scintillation scanning of human spleen, Philip M. Johnson and John C. Herion, March, 438

**COURT BROWN, W. M.**, **DOLL, R.**, **SPIERS, F. W.**, **DUFFY, B. J.**, and **McHUGH, M. J.**: Geographical variation in leukemia mortality in relation to background radiation and other factors (ab), April, 697

**COWAN, NAIRN R.**: The transverse diameter of the heart in older people (ab), April, 664

**COWLEY, R. ADAMS**. See **BLOEDORN, FERNANDO G.**

**CRAMER, R. A.** See **FOLSOM, T. R.**

**CRANIOPHARYNGIOMA**. See **Pituitary Body**

**CRANIUM**  
See also **Occipital Bone**; **Sphenoid Bone**  
—craniobuccal origin, signs, and treatment of craniopharyngiomas (ab), James B. Campbell and Frank M. Hudson, June, 991

**abnormalities**  
—diagnostic approach to infant with an enlarging head (ab), Frederick Murtagh and John A. Kirkpatrick, Jan., 142

**cysts**. See **Cranium, tumors**

**pathology**  
—skull in hyperparathyroid bone disease (ab), Kent Ellis and Robert J. Hochstim, Feb., 312

**roentgenography**  
—assessment of methods for determination of position of pineal gland in lateral skull roentgenograms (ab), C. B. Lamont and D. G. Wollin, May, 839

—method for roentgenologic measurements from spot fluorograms; its application to skull capacity determination (ab), E. Koivisto et al, June, 983

—new device for skull radiography (ab), W. Renner, Feb., 312

—study of roentgen appearance of cranial vault sutures: correlation with their anatomy (ab), John B. Christensen et al, Feb., 313

**tumors**  
—epidermoid cyst of skull; case observed for 16 years, Benjamin E. Greenberg, Jan., 107

**CRAWFORD, E.**, **STANLEY**. See **MORRIS, GEORGE C., Jr.**

**CRICOHYOID MEMBRANE**  
—percutaneous cricothyroid membrane bronchography, Samuel D. Henley, Edward J. Arida, A. Monroe Diggs and Sumner L. Freeman, May, 763. See also **correction**, June, 980

**CRONKITE, E. P.**, **SELLABARGER, C. J.**, **BOND, V. P.**, and **LIPPINCOTT, S. W.**: Studies on radiation-induced mammary gland neoplasia in the rat. I. The role of the ovary in neoplastic response of breast tissue to total- or partial-body x-irradiation (ab), April, 701

—See **BOND, V. P.**  
—See **SELLABARGER, C. J.**

**CROSBY, WILLIAM H.** See **DANIELL, HARRY W.**

**CROSTA, CLEMENTE**, and **FAVERO, PIER ALESSANDRO**: On results obtained with tomographic examination in the study of the bile ducts with intravenous cholangiography (ab), May, 849

**CROWELL, DAVID L.**: Effort thrombosis of the subclavian and axillary veins: review of the literature and case report with two-year follow-up with venography (ab), April, 672

**CRUZ, HIPÓLITO**. See **MOREY, GILBERTO**

**CULVER, GORDON J.**, **PIRSON, HERBERT S.**, **MILCH, ELMER**, **BERMAN, LEONARD**, and **ABRANTES, F. JORGE**: Intramural hematoma of the jejunum. A case report, May, 785

—and **TANNENHAUS, JOSEPH**: Calcification of the vas deferens in diabetes (ab), April, 685

**CUPP, HORACE B., Jr.** See **TINDALL, GEORGE T.**

**CURRENT, JAMES P.**, **HALES, IAN B.**, and **DOBINS, BROWN M.**: The effect of 2,3-dimercaptopropanol (BAL) on thyroid function (ab), Jan., 171

**CUSHING'S SYNDROME**  
—osteoporosis in Cushing's syndrome (ab), A. Iannaccone et al, Jan., 159  
—roentgen diagnosis of adrenal tumor in Cushing's syndrome (ab), A. Iannaccone et al, April, 685

**CUSHWAY, BERTRAM CHARLES** (obit), Feb., 303

**CYSTINE AND CYSTEINE**  
—protective effects on fecundity and fertility from feeding cysteine and glutathione to *Habrobracon* females before x-irradiation (ab). Daniel S. Grosch, May, 866

**CYSTOGRAPHY.** See Bladder, obstruction

**CYSTS**  
See also Adrenals, tumors; Cranium, tumors; Kidneys, tumors; Liver, cysts

**dermoid.** See Tumors, dermoid

**CYTOTOLOGY.** See Stomach, cancer; Uterus, cancer

**CYWES, S., and KRIGE, H.**: Intravenous cholangiography and tomography as an aid in the diagnosis of ascariasis of the biliary tract (ab), April, 680

**D**

**DACIE, J. V.** See LEWIS, S. M.

**DALE, W. M., DAVIES, J. V., GREENE, DAVID, and KEENE, J. P.**: The relative biological efficiency of 20 Mrad and 4 Mrad radiations. A report from the Medical Research Council Group, Christie Hospital, Manchester 20 (England), III. The oxidation of ferrous sulphate solution (ab), March, 530

—and RUSSELL, C.: The relative biological efficiency of 20 Mrad and 4 Mrad radiations. A report from the Medical Research Council Group, Christie Hospital, Manchester 20 (England), IV. Experiments on the survival of *E. coli* B (ab), March, 530

**DALITH, F.**: Calcification of the aortic knob: its relationship to the fifth and sixth embryonic aortic arches. A radiological and anatomical study, Feb., 213

**DAMANSKI, MAREK.** See ROSS, J. COSBIE

**DANA, EDWARD R.** See KOEHLER, P. RUBEN

**DANIELL, HARRY W., and CROSBY, WILLIAM H.**: Effect of isologous bone marrow-spleen cell suspension on survival of swine exposed to radiation from a nuclear weapon (ab), April, 702

**DANIELS, VIRGIL C., and WOOD, ERNEST H.**: Diverticulitis of cecum and ascending colon (ab), Jan., 156

**DARDEN, EDGAR B., Jr.**: Changes in membrane potentials, K content, and fiber structure in irradiated frog sartorius muscle (ab), March, 529

**DAVIES, MARVIN L.** See ISAACS, JAMES P.

**DAVIES, E. R.** See SMITH, W. G.

**DAVIES, J. V.** See DALE, W. M.

**DAVIES, JACK.** See TERRY, CAROLYN W.

**DAVIS, ARTHUR E., Jr.**: Simultaneous occurrence of osteitis deformans and Hottokin's disease (ab), March, 512

**DAVIS, G. K.** See GOLD, JEROME A.

**DAVIS, HAROLD.** See FOMON, JOHN J.

**DAVIS, HUGH JAMES, JONES, HOWARD W., Jr., and DICKSON, ROBERT J.**: The bioassay of host radiosensitivity. An index of radioimmunoassayability applied to carcinomas (ab), Feb., 339

**DAVIS, JOHN W.** See GOLD, JEROME A.

**DAVIS, RICHARD L.** See BERNSTEIN, EUGENE F.

**DAYWITT, ALVIN L.** See KEYTING, WALTER S.

**DE BAKEY, MICHAEL E.** See MORRIS, GEORGE C., Jr.

**DEBBAS, JOSEPH N.** See LEHMAN, J. STAUFFER

**DEFRENNER, P.** See BERAUD, CL.

**DEGLUTITION**  
disorders  
—dysphagia and hypertrophic spurring of cervical spine (ab), David A. Hilding and Mihran O. Tachdjian, May, 852

**DEGROOT, LESLIE J., and CARVALHO, EVELYN**: Studies on proteins of normal and diseased thyroid glands (ab), Jan., 172

**DE LUCA, JAMES T.** See LOWMAN, ROBERT M.

**DEMOLIN, M.**: Disco-vertebral necrosis after aortography (ab), March, 502

**DENT, JAMES NORMAN.** See LYNN, W. GARDNER

**DERMATOLOGY AND DERMATOLOGISTS.** See Skin, cancer

**DESHMUKH, MADHUKAR, GUVENC, SULAHATTIN, BENTIVOGLIO, LAMBERTO, and GOLDBERG, HARRY.**: Idiopathic dilatation of the pulmonary artery (ab), March, 503

**DEVAS, M. B.**: Stress fractures of the patella (ab), Jan., 161

**DEWEES, JAMES A.** See ROGOFF, STANLEY M.

**DEX, WALTER J.** See RUBIN, ROBERT J.

**DEXTROX**  
—further experimental and early clinical observations concerning the protective action of low molecular weight dextran upon intravenous Hypaque toxicity, Eugene F. Bernstein, Robert L. Evans, John A. Blum and Robert F. Avant, Feb., 260

**DIABETES MELLITUS**  
—calcification of vas deferens in diabetes (ab), Gordon J. Culver and Joseph Tannenhaus, April, 685

— $I^{131}$  triolein tolerance curves in patients with diabetes mellitus: their similarity to those observed in myocardial infarction (ab), Herschel Sandberg et al, April, 693

—primary diabetic pneumaturia diagnosed radiographically (ab), Albert P. Marsh, Jan., 163

—roentgenographic manifestations of diabetes mellitus (ab), Martin W. Donner and John G. McAfee, June, 991

**DIALYSIS**  
—continuous monitored dialysis-perfusion device for study of two compartment systems, Ervin Kaplan and John J. Iamisio, Jan., 123

**DIAPHRAGM.** See Hernia, diaphragmatic

**DICKSON, ROBERT J.** See DAVIS, HUGH JAMES

**DIEPEVEEN, W. P., HJORT, G. H., and POCK-STEEN, O. CH.**: Adamantinoma of the capitite bone (ab), April, 682

**DIET.** See Gluten; Manganese

**DIGESTIVE SYSTEM**  
See also Gastrointestinal Tract; Stomach, etc.

**diseases**  
—x-ray negative dyspepsia: follow-up study (ab), Pekka Brummer and Ilkka Häkkinen, Jan., 153

**DIGGS, A. MONROE.** See HEMLEY, SAMUEL D.

**DILLON, ROBERT F.** See LUAN, LAWRENCE L.

—See LYNNFIELD, JOSHUA

**DIMERCAPROL**  
—effect of 2,3-dimercaptopropanol (BAL) on thyroid function (ab), James V. Current et al, Jan., 171

**DIODRAST.** See Kidneys, function tests

**DISCOGRAPHY.** See Spine, intervertebral disks

**DISEASES**  
See also under names of diseases  
—disease conditions in animals, with radiographic findings, that are also present in man, Stuart A. Patterson, May, 818

**DITRIOKON.** See Cardiovascular System, roentgenography

**DIURETICS**  
—effect of diuretics upon serum protein bound iodine and thyroid uptake of radioactive iodine (ab), David E. Schteingart et al, June, 994

—studies with chlorothiazide tagged with radioactive carbon ( $C^{14}$ ) in human beings (ab), Herbert R. Bretell et al, May, 858

**DIVERTICULA.** See Arachnoid; Cecum; Intestines; Kidneys; Pharynx; Ureters, etc.

**DIVERTICULITIS, MATTHEWB.** See HARRISON, EDGAR G., Jr.

**DJERASSI, ISAAC, WOODRUFF, ROBERT, and BARBER, SIDNEY.**: Survival of total-body x-irradiated mice after delayed infusions of isologous bone marrow (ab), June, 997

**DNA** (desoxyribonucleic acid). See Nucleins

**DOBGEN, GLEN D.**: Benign adenomatous polycystic kidney tumor (Perlmann's tumor), Jan., 100

**DOBSON, R. LOWRY.** See WEAVER, JOHN C.

**DOBY, T.**: Use of "radiopaque streamer" to show blood currents in the heart, June, 918

**DOBYNS, BROWN M.** See CURRENT, JAMES V.

—See HALLES, IAN B.

**DODD, N. F., LEVY, D. W., and JACKSON, W. P. U.**: Environmental bone disease of hitherto undescribed type (ab), May, 850

**DODSON, VERNON N.** See FLOYD, JOHN C., Jr.

**DÖPPER, TH.**: Roentgen diagnosis of injuries of the thorax due to blunt trauma (ab), March, 496

**DOHLMAN, GÖSTA, and MATTSSON, OVE**: The endoscopic operation for hypopharyngeal diverticula. A roentgenographic study (ab), March, 494

**DOLAN, PATRICK A., and KIRKPATRICK, W. E.**: Multiple ureteral diverticula (ab), March, 515

**DOLCE, G., and RAMELLA, G.**: Injection into the vertebral arteria via the posterior route (ab), May, 840

**DOLEČEK, R.** See STĚPÁNEK, V.

**DOLL, R.** See COURT BROWN, W. M.

**DONIACH, I., and SHINER, MARGOT**: Malabsorption syndromes: a symposium. V. Histopathology of the stomach in pernicious anaemia and jejunum in steatorrhoea (ab), April, 679

**DONNER, MARTIN W., and McAFFEE, JOHN G.**: Roentgenographic manifestations of diabetes mellitus (ab), June, 991

**DORTA, T., BÉRAUD, TH., and VANNOTTI, A.**: Iodine metabolism in the ectopic thyroid (ab), Jan., 171

**DOSE FRACTIONATION.** See Roentgen Rays, effects; Skin, cancer

**DOSIMETERS AND DOSIMETRY**  
See also Radioactivity; Roentgen Therapy; Units of Radiation

—cobalt-60 depth-dose corrections as determined from transmission-dose measurements, R. J. Schulz, G. A. Cohen, J. P. Tsai and J. C. Evans, May, 805

—comparison of two fluorometers designed to measure radiation-induced fluorescence of silver-activated glass rods, Nathaniel F. Barr, Mary Stark and J. S. Laughlin, Jan., 113

—"ideal" in vivo dosimetry system for clinical and experimental radiation therapy, B. Roswit, S. J. Malsky, C. G. Amato, C. B. Reid, L. Maddalone and C. Spreckels, Feb., 295

—measurement of radiant energy levels in diagnostic roentgenology, Russell H. Morgan, June, 867

—multiple implant dosimetry, C. G. Amato, S. J. Malsky, V. P. Bond and B. Roswit, Feb., 292

—on adequacy of half-value layer as a criterion of x-ray quality in calibration of dosimeters (ab), N. M. Procter and J. R. Greening, March, 523

—physical aspects of cobalt-60 teletherapy using wedge filters. I. Physical investigations. II. Dosimetric considerations (ab), M. Cohen et al, March, 525

—practical uses for the radiation polymerization dosimeter in radiation therapy, Frank E. Hoecker, Jan., 116

—radiophotoluminescent gamma-ray dosimetry of mixed neutron gamma-ray radiation fields, C. G. Amato and S. J. Malsky, Feb., 290. See also correction, May, 830

—second conference on microdosimetry, Rochester, N. Y., Feb., 305

**DOTTER, CHARLES T.**: Left ventricular and systemic arterial catheterization: a simple percutaneous method using a spring guide (ab), April, 671

—See **STARR, ALBERT**

**DOUB, HOWARD P.**: Awarded silver tray by Radiological Society of North America, Feb., 299

**DOUB, HOWARD P.**, and **SHEA, JAMES J.**: Pneumatosis cystoides intestinalis (ab), Jan., 157

**DOWD, J. E.**: See **BORJA, LILIA LOPEZ**

**DOWLING, J. THOMAS, INGBAR, SIDNEY H.**, and **FREINKEL, NORBERT**: Iodine metabolism in hydatidiform mole and choriocarcinoma (ab), Jan., 173

**DRESSLER, WILLIAM**: Percussion of the sternum. I. Aid to differentiation of pericardial effusion and cardiac dilation (ab), April, 666

**DREYFUSS, JACK R.**: See **LEADBETTER, GUY W., Jr.**

**D'SILVA, J. L.**: See **FOUCHÉ, R. F.**

**D'SILVA, JOSEPH LLOYD**: See **LUAN, LAWRENCE L.**

**DUCTUS ARTERIOSUS**

- radiology of patent ductus arteriosus (ab), John A. Campbell and Eugene C. Klatte, Jan., 147

**DUFFY, B.**: See **COURT BROWN, W. M.**

**DULLUM, DELL F.**: Radiation: registration of sources (ab), Feb., 350

**DUMPING SYNDROME**: See Peptic Ulcer, surgical therapy; Stomach, surgery

**DUNBAR, J. D.**: See **MELHEM, R. E.**

**DUNBAR, J. SCOTT, GOLDBLOOM, RICHARD B., POLLACK, VICTOR**, and **RADFORD, REX**: An automatic device for voiding urethrogram in infants and small children, March, 467

**DUNJIC, A., MAISIN, J., MALDAGUE, P.**, and **MAISIN, H.**: Incidence of mortality and dose-response relationship following partial-body x-irradiation of the rat (ab), May, 863

**DUODENAL TUBE**

- effect of gastric intubation on normal mechanisms preventing gastroesophageal reflux (ab), Richard Nagler et al., April, 675

**DUODENUM**

- duodenocolic apposition (ab), M. H. Poppel, March, 507
- effect of Seegeran on duodenum and common bile duct (ab), Paul Edholm, March, 511
- dilatation

  - big duodenum (ab), Harry W. Fischer, April, 677
  - contribution to roentgen diagnosis of annular pancreas with report of 2 cases, I with an unusually large duodenal dilatation (ab), R. Walko, Feb., 326

- obstruction

  - arteromesenteric occlusion of duodenum: an entity? (ed), Christian V. Cimmino, May, 828
  - carcinoma of pylorus simulating benign duodenal obstruction (ab), Charles H. Brown, Feb., 323

- roentgenography

  - right renal enlargements causing alterations in descending duodenum: a radiographic demonstration, Irwin Bluth and Peter Vitale, May, 777

- tumors

  - duodenal polyposis associated with mucocutaneous melanosis (Peutz-Jeghers syndrome) (ab), Arthur S. Tucker and Robert P. Boland, Jan., 154
  - leiomyosarcoma of duodenum: collective review (ab), T. E. Starzl et al., Feb., 322

- ulcers. See Peptic Ulcer

**DUOGRAFIN**: See Biliary Tract; Pyelography

**DuSHANE, JAMES W.**, and **KIRKLIN, JOHN W.**: Selection for surgery of patients with ventricular septal defect and pulmonary hypertension (ab), Jan., 148

—See **LAUER, RONALD M.**

—**WEIDMAN, WILLIAM W., BRANDENBURG, ROBERT O.**, and **KIRKLIN, JOHN W.**: Differentiation of interatrial communications by clinical methods. Ostium secundum, ostium primum, common atrium, and total anomalous pulmonary venous connection (ab), Jan., 147

**DUTHIE, H. L.**, and **McKELLAR, N. J.**: Radiological appearances in the postgastrectomy dumping syndrome (ab), Jan., 154

**DUXBURY, JAMES H.**: See **LEADBETTER, GUY W., Jr.**

**DWARFISM**

- unusual form of familial osteodystrophy (ab), H. Stuart Barber, June, 988

**DWORKEN, HARVEY J.**: Recent experiences with spontaneously disappearing gallstones (ab), March, 510

**DYCHE, G. M.**: See **HOWARD, N.**

**DYCLONE**: See Bronchi, roentgenography

**DYKE, W. P., FLOYD, ROSS**, and **GRUNDHAUSER, F. J.**: High dose rate x-ray sources with development of a light-weight diagnostic unit, Feb., 257

**DYNES, JOHN B.**, and **SMEDAL, MAGNUS I.**: Radiation myelitis (ab), Jan., 176

**DYSGERMINOMA**: See Tumors, seminoma

**DYSOSTOSIS, MANDIBULOFACIAL**: See Jaws

**DYSPEPSIA**: See Digestive System

**DYSPHAGIA**: See Deglutition, disorders

**E**

**EAR**

- See also Otosclerosis
- CANCER**
- some clinical aspects of megavoltage: treatment of carcinoma of middle ear by 4 Mev linear accelerator (ab), K. S. Holmes, Feb., 340

**ossicles**

- radiation necrosis of ossicles (ab), Joseph Gyorkay and Frederic J. Pollock, March, 527

**EASTWOOD, W. S.**: The design of caesium sources for teletherapy (ab), May, 860

**ECHINOCOCCOSIS**: See Lungs, echinococcosis

**EDEMA**: See Arms

**EDHOLM, PAUL**: Effect of Seegeran on the duodenum and common bile duct (ab), March, 511

Gallbladder evacuation in the normal male induced by cholecystokinin (ab), Feb., 326

**EDITORIALS**

- Arteromesenteric occlusion of the duodenum: an entity? Christian V. Cimmino, May, 828
- Berg, H. Milton, president of the Radiological Society of North America, Feb., 296
- Forty-sixth annual meeting, Feb., 298
- Graduate programs in the radiological basic sciences, Frederick J. Bonte, for the Commission on Education of the American College of Radiology, June, 973
- Hazards of medical irradiation, Robert J. Bloor, June, 970
- On the labeling of shadows, E. R. N. Grigg, April, 644
- Some logistics of the Radiological Society of North America, with thoughts about the future, presidential address, Theodore J. Wachowski, March, 480
- Statistics and the physician, Christian V. Cimmino, Jan., 128. See also letter to editor, R. R. Newell, May, 831

**EDMONDSON, WILLIAM R.**, and **GERE, J. BREWSTER**: Pulmonary alveolar proteinosis (ab), April, 662

**EDSMYR, FOLKE H.**, and **EKSTRÖM, TORE**: Carcinoma of the penis. A clinical study of 229 cases (ab), Jan., 170

**EDUCATION**

- course, advances in clinical radioisotope instrumentation, Oak Ridge Institute of Nuclear Studies, April, 650
- course in radiology of chest, Indiana University, March, 486
- graduate programs in the radiological basic sciences (ed), Frederick J. Bonte, for the Commission on Education of the American College of Radiology, June, 973
- international cancer fellowships, May, 830
- neuroradiology course, Columbia University, New York, Feb., 305
- postgraduate course, diseases of the chest, University of Wisconsin, Feb., 305
- postgraduate course in ocular radiology, New York Eye and Ear Infirmary, May, 830
- radiation courses, Queens Hospital Center, New York, May, 830
- radiologic physics course, Columbia University, New York, April, 649
- University of Cincinnati, refresher course in diagnostic roentgenology, April, 649

**EDWARDS, JESSE E.**: See **LAUER, RONALD M.**

**EFFUSIONS**

- See also Ascites; Pericarditis, with effusion; Pleurisy, with effusion
- treatment of pleural and peritoneal carcinomatous effusions with radioactive gold (1956-1959) (ab), Poul B. Hansen and Agner Haug, Feb., 345

**EGER, G.**: See **ROTH, F.**

**EGGLESTON, WILLIAM**: See **NELSON, SIDNEY W.**

**EHRLICH, D. E.**: See **SUTRO, C. J.**

**EINHORN STRING TEST**: See Gastrointestinal Tract, hemorrhage

**EKMAN, CARL-AXEL**: See **FOSTER, JOHN H.**

**EKSTRÖM, TORE**: See **EDSMYR, FOLKE H.**

**ELECTRICITY**

- medical electronics and electrical techniques in medicine and biology; combined conferences, June, 978
- roentgenological bone findings after high-voltage injury (ab), J. Kolář and R. Vrabc, Feb., 347

**ELECTROENCEPHALOGRAPHY**: See Brain, electroencephalography

**ELECTRONICS**

- medical electronics and electrical techniques in medicine and biology; combined conferences, June, 978

**ELECTRONS**

- See also Betatron; Linear Accelerator
- advantages of employing mixed high-energy x-ray and electron beams in radiation therapy (ab), Noel H. Gale and G. S. Innes, May, 857
- dose distribution in grid therapy with 15- to 33-Mev electrons, J. Ovadia and J. McAllister, Jan., 118

**ELECTROPHYSIOLOGY**

- bioelectric activity of mammalian nerves during x-irradiation (ab), C. S. Bachofen and M. E. Gautereaux, June, 998
- bioelectric responses in situ of mammalian nerves exposed to x-rays (ab), C. S. Bachofen and M. E. Gautereaux, March, 529

**ELKIN, MILTON**: The prone position in intravenous urography for study of the upper urinary tract, June, 961

**ELLER, MILTON, SILVER, SOLOMON, YOHALEM, STEPHEN B.**, and **SEGAL, ROBERT L.**: The treatment of toxic nodular goiter with radioactive iodine: 10 years' experience with 436 cases (ab), April, 692

**ELLIOTT, G. A.**: Accidental acute irradiation from cobalt-60, April, 694

**ELLIS, F. HENRY, Jr.**: See **NADEAU, PIERRE J.**

**ELLIS, JAMES P., Jr., CLARK, ROBERT T., Jr., RAMBACH, WALTER A.**, and **PICKERING, JOHN E.**: Prompt effects of high-level irradiation on animal metabolism (ab), April, 697

**ELLIS, KENT, and HOCHSTIM, ROBERT J.:** The skull in hyperparathyroid bone disease (ab), Feb., 312

**EMBOLISM**

- marrow embolism and intraosseous contrast radiography (ab), Hyman L. Gildenhorn et al., April, 684
- gas** —gas embolization of portal venous system (ab), Noah Susman and Hyman R. Senturia, March, 505
- pulmonary** —behavior in circulation of the radioactive pulmonary embolus and its application to the study of fibrinolytic enzymes (ab), Michael Hume et al., Feb., 346
- fatal embolism of pulmonary capillaries; report of case associated with routine barium enema (ab), Keith M. Truemmer et al., May, 848
- hypertradiancy of one lung field and its experimental production by unilateral miliary embolization of pulmonary arteries in cats (ab), R. F. Fouché and J. L. D'Silva, March, 501
- pulmonary embolization following urethrogram with an oily medium (ab), Aaron H. Ulm and Ely C. Wagshul, May, 856

**EMBRYO.** See also Fetus

- effect of  $\gamma$ -irradiation on embryos at critical stages of heart development (ab), W. M. Copenhagen et al., April, 699
- indirect effect of irradiation on embryonic development. I. Irradiation of mother while shielding embryonic site (ab), Robert L. Brent and Mary M. McLaughlin, May, 863
- indirect effect of irradiation on embryonic development. II. Irradiation of placenta (ab), Robert L. Brent, May, 864

**EMERGENCIES. See Abdomen, acute conditions**

**EMOTIONS**

- effects of certain physical and emotional tensions and strains on fluctuations in level of serum protein-bound iodine (ab), Robert Volpé et al., Feb., 342

**EMPHYSEMA**

- pulmonary** —localized emphysema (ab), S. Brünner and O. Ch. Pock-Steen, Jan., 144
- localized obstructive emphysema produced by extrabronchial lesion (ab), Carl Oshrain and Coleman H. Posenberg, Jan., 144
- objective diagnostic routine for pulmonary emphysema (ab), W. Schröder, March, 500
- relationship of hyperinflated lung to obstructive pulmonary disease (ab), Neville M. Lefcœ and Gerald Goodall-Copestake, Jan., 144
- unilateral emphysema (ab), R. F. Fouché et al., Feb., 314
- retroperitoneal** —retroperitoneal emphysema as a complication of barium enema (ab), F. J. Brunton, May, 849

**ENCEPHALOGRAPHY. See Brain, roentgenography**

**ENCEPHALOMYELITIS**

- permeability of cerebral blood vessels in experimental allergic encephalomyelitis studied by radioactive iodinated bovine albumin (ab), M. Vulpe et al., Jan., 173

**ENDOCARDIUM. See Heart, endocardial fibroelastosis**

**ENDOSCOPY. See Pharynx, diverticula**

**ENEMAS**

- See also Intestines, roentgenography
- complications** —entrance of barium into intestinal glands during barium enema (ab), Leon Sisson, March, 507
- evaluation of hazards of barium-enema examination (ab), Roger Pyle and Eric Samuel, May, 848
- fatal embolization of pulmonary capillaries; report of case associated with routine barium enema (ab), Keith M. Truemmer et al., May, 848
- retroperitoneal emphysema as complication of barium enema (ab), F. J. Brunton, May, 849

**ENNUYER, A. See BACLESSE, F.**

**ENTEROGRAPHY. See Intestines, roentgenography**

**ENVIRONMENT**

- environmental bone disease of hitherto undescribed type (ab), N. F. Dodd et al., May, 850

**ENZYMES**

- behavior in circulation of the radioactive pulmonary embolus and its application to study of fibrinolytic enzymes (ab), Michael Hume et al., Feb., 346
- serum enzymes following whole-body radiation in the rabbit (ab), Harry G. Albaum, May, 864

**EOSINOPHILS**

- eosinophilic pneumonia; 2 cases with pulmonary biopsy (ab), Anthimos J. Christoforidis and William Molnar, March, 498
- granuloma, eosinophilic. See Bladder, tumors; Bones, tumors
- periarteritis nodosa with labile and recurrent pleuropulmonary manifestations without asthma or serum hypereosinophilia (ab), J. Turiaf et al., Feb., 316

**EPHYSES**

- chondrolystrophy congenita punctata (Conradi's disease); review of literature and report of case with unusual features (ab), Mathea Allansmith and Edward Senz, May, 851
- early recognition of osteochondrosis of capital epiphysis of femur (ab), Bernard W. Jacobs, Jan., 161
- familial epiphysial dysplasia of lower limbs (ab), H. Weinberg et al., March, 515
- fracture separation of lower humeral epiphysis; case (ab), Leonard Marmor and Charles O. Bechtol, Jan., 160
- pathology of slipped upper femoral epiphysis; new concept (ab), A. M. Rennie, March, 514

**EPITHELIOMA. See Maxillary Sinus; Skin; Tonsils**

**EPP, EDWARD R. See BLATZ, HANSON**

**ERHARD, GERALD A., BANNING, WILLIAM V., and PIATT, ARNOLD D.:** Primary lymphosarcoma (reticulum cell) of the stomach (case report) (ab), Feb., 338

**ERNST, RICHARD. See AMPLATZ, KURT**

**ERSHOFF, BENJAMIN H., and BRAT, VED:** Comparative effects of prenatal gamma radiation and x-irradiation on the reproductive system of the rat (ab), March, 530

Failure of AET to protect against testes injury in the x-irradiated rat (ab), Feb., 349

**ERYTHROCYTES**

- life cycle of erythrocytes of irradiated animals studied by  $\text{Fe}^{55}$  (ab), B. Bellion and L. Resegotti, May, 859
- radioactive iron techniques in clinical practice (ab), Walter Lentino et al., May, 858
- red cell repopulation in irradiated mice treated with plethoric homologous bone marrow (ab), Joan W. Goodman and Ray D. Owen, Feb., 349

**destruction. See also Hemolysis**

- $\text{Cr}^{51}$  labeled red blood cells in study of splenomegaly and sites of hemocathexis (ab), A. Fieschi et al., May, 859
- pattern of erythrocyte destruction in hemolytic anemia, as studied with radioactive chromium (ab), S. M. Lewis et al., Feb., 345

**ESOPHAGOSCOPY**

- importance of radiographic examination of esophagus and routine chest radiography after esophagoscopy (ab), George Cohen and Joseph Katz, Feb., 320

**ESOPHAGUS**

- acute radiation effects in esophagus (ab), F. Lamont Jennings and Anne Arden, April, 698
- effect of gastric intubation on normal mechanisms preventing gastroesophageal reflux (ab), Richard Nagler et al., April, 675

**cancer**

- preoperative irradiation for cancer of esophagus (ab), Eugene E. Cliftton et al., April, 689

**obstruction**

- arterial malformation in superior mediastinum (ab), S. Brünner et al., Jan., 148

**roentgenography**

- importance of radiographic examination of esophagus and routine chest radiography after esophagoscopy (ab), George Cohen and Joseph Katz, Feb., 320
- motility changes revealing esophagogastric junction (ab), Majic S. Potsaid, Goro Irie and Nathan T. Griscom, Feb., 262
- radiologic localization of esophageal hiatus as determined by intraluminal pressure measurements, Bernard S. Wolf and Bernard R. Cohen, June, 903
- use of cineradiography in routine diagnosis of disease of upper gastrointestinal tract; experience in 1,000 cases (ab), Joseph Jorgens et al., April, 675

**SPASMS**

- brief massive spasm of distal esophagus greatly increasing gastric herniation, documented cineradiographically in patient with lower esophageal ring (ab), Herbert M. Stauffer et al., Feb., 320

**stricture**

- brief massive spasm of distal esophagus greatly increasing gastric herniation, documented cineradiographically in a patient with lower esophageal ring (ab), Herbert M. Stauffer et al., Feb., 320

**tumor**

- esophageal tumor; case (ab), Rossall Sealy and H. Krieg, Jan., 152

**varix**

- evaluation of vertebral venography (ab), M. H. Nathan and Luis Blum, April, 671

**ESTRADIOL. See Estrogens**

**ESTREN, SOLOMON. See BRODY, EUGENE A.**

**ESTROGENS**

- do estrogenic and androgenic hormones affect the radiation reaction of tumors? Henry P. Plenk, Fred M. Sorenson and Roger B. Fuson, Feb., 270
- estradiol reduces incorporation of radioactive sulfate into cartilage and aortas of rats (ab), Robert E. Priest et al., May, 861

**EUSTACHIAN TUBE**

- radiologic evaluation of eustachian tube function (ab), W. E. Comper Jr., March, 495

**EVANS, J. C. See SCHULZ, R. J.**

**EVANS, JAMES A. See SMIDAL, MAGNUS I.**

**EVANS, JOHN A. See FOCHT, ELIZABETH F.**

**See STEINBERG, ISRAEL**

**EVANS, ROBERT L. See BERNSTEIN, EUGENE F.**

**EVANS, WILLIAM. See CATTERALL, MARY**

**EVAN, R., and SORS, CH.:** Primary pleural cancers. An attempt at classification of primary pleural tumors (ab), Feb., 315

**EWART, J. A., STURTEVANT, H. N., and SULLIVAN, B. H., Jr.:** An evaluation of the Einhorn string test (ab), May, 848

**EXTREMITIES**

- See also Arms; Legs; under names of bones
- blood supply** —correlation of radiographic findings with clinical features of degenerative arterial disease (ab), G. D. Tracy et al., March, 502

**EXTREMITIES, blood supply**—*cont.*  
 —phlebography of lower extremity (ab), Stanley M. Rogoff and James A. De Weese, Feb., 320  
 —serial femoral arteriography in occlusive disease: clinical-roentgenologic considerations with a new classification of occlusive patterns (ab), Henry Haimovici et al., April, 670  
 —vascular patterns in immobilized, denervated, or devascularized rabbit limbs (ab), Albert B. Ferguson, Jr., and Yoshihiko Akahoshi, April, 684  
**tumors**  
 —differential diagnosis of benign and malignant tumors of extremity with aid of angiography (ab), L. Mucci et al., May, 846

**EYES**  
 See also Cornea; Optic Canal; Orbit; Retina  
 —dose to eye from radiographic procedures, Elizabeth F. Focht, George R. Merriam, Jr., Mary Barnes and John A. Evans, March, 459  
**blood supply**  
 —experimental intraocular venography (ab), Bruce E. Cohen, April, 671  
**foreign bodies**  
 —comment on article by Mintz and Mattes on bone-free detection of intraocular foreign bodies (letter to editor), J. Worst, April, 650  
**roentgenography**  
 —postgraduate course in ocular radiology, New York Eye and Ear Infirmary, May, 830

**TYLER, WILLIAM R.** See SMITH, RICHMOND W., Jr.

**F**

**FABRIKANT, JACOB I.** See KOEHLER, P. RUBEN

**FACE**  
 —mandibulofacial dysostosis on the roentgen film (ab), J. E. W. Brocher and D. Klein, May, 840  
 —rotational tomography of face (ab), Sydney Blackman, May, 840

**FAMILIAL CONDITIONS**  
 See also Heredity  
 —familial epiphysial dysplasia of lower limbs (ab), H. Weinberg et al., March, 515  
 —familial idiopathic cerebral calcifications in childhood (ab), Johannes C. Melchior et al., April, 659  
 —familial muscular subaortic stenosis: an unrecognized form of "idiopathic heart disease," with clinical and autopsy observations (ab), Lawrence B. Brent et al., Feb., 318  
 —unusual form of familial osteodystrophy (ab), H. Stuart Barber, June, 988

**FANT, WILLIAM M.** See SLOAN, ROBERT D.

**FARBER, SIDNEY.** See DJERASSI, ISAAC

**FARMERS AND FARMING**  
 —farmer's lung; 2 cases (ab), William P. Baldus and James B. Peter, Feb., 315

**FARR, LEE E.** See LIPPINCOTT, STUART W.

**FAT**  
 See also Triolein  
 —clinical assessment of intestinal fat-absorption using radioactive fat (ab), W. F. Walker et al., March, 524  
 —distended gallbladder: value of fat meal in cholecystography (ab), Maurice D. Sachs and Philip F. Partington, March, 509  
 — $^{131}$ I-labeled fat and pancreatic fat as a differential absorption test in patients with steatorrhea (ab), Abraham A. Polachek and Robert F. Williard, April, 693  
 —rapid screening method for  $^{131}$ I fat-absorption test, Leonard Rosenblatt, Feb., 251  
 —use of radioactive iodine labeled triolein in evaluation of fat absorption following cholecystectomy (ab), E. J. Fedor and Bernard Fisher, June, 903

**FATEMI, ALL.** See KEGEL, RICHARD F.C.

**FAVERO, PIER ALESSANDRO.** See CROSTA, CLEMENTE

**FAVIS, EDWARD A., KERMAN, HERBERT D., and SCHILDECKER, WILLIAM.** Multiple myeloma manifested as a problem in the diagnosis of pulmonary disease (ab), Feb., 317

**FECAILITH.** See Feces

**FECESS**  
 —clinical and radiographic study of appendiceal fecaliths: review of literature and report of 7 cases (ab), Robert Caras and Marvin J. Friedenberg, Feb., 325

**FECONDITY**  
 —protective effects on fecundity and fertility from feeding cysteine and glutathione to Habrobracon females before  $\gamma$ -irradiation (ab), Daniel S. Grosch, May, 866

**FEDOR, E. J., and FISHER, BERNARD.** The use of radioactive iodine labeled triolein in the evaluation of fat absorption following cholecystectomy (ab), June, 993

**FEIGENBAUM, LAWRENCE Z.** See VAETH, JEROME M.

**FEINBERG, LEONARD.** See SANDBERG, HERSCHEL

**FEINBERG, S. B.** Dysgerminoma of the ovary: unusual roentgen manifestation of metastases (ab), March, 522

—LESTER, R. G., and BURKE, B. A.: The roentgen findings in *Pneumocystis carinii* pneumonia, April, 594

**FEIST, JOHN H., and LASSEK, ELLIOTT C.** Pheochromocytoma with large cystic calcification and associated spine-rib ridge malformation, Jan., 21

**FELDMAN, ROBERT.** See SHELLINE, GLENN E.

**FELLOWSHIPS.** See Education

**FELSON, BENJAMIN.** See TOOMEY, FRANCES B.

—See ZEID, SHERWIN S.

**FEMUR**  
**diseases**  
 —erosion of femoral shaft due to patellofemoral osteoarthritis (ab), Colin Alexander, March, 514

**epiphyses.** See Epiphyses

**fractures**  
 —radioactive isotopes in fractures of neck of femur (ab), G. P. Arden, Jan., 174

—extradural osseous lesions simulating the disk syndrome (ab), Harry R. Walker, Jan., 160

**FERGUSON, ALBERT B., Jr., and AKAHOSHI, YOSHIHICO.** Vascular patterns in immobilized, denervated, or devascularized rabbit limbs (ab), April, 684

**FERNSTRÖM, INGEMAR.** See BORELL, ULF

**FERRARA, RICHARD J.** The private dermatologist and skin cancer. A clinical study of two hundred twenty-six epitheliomas derived from five dermatologic practices (ab), Feb., 337

**FERRBEE, JOSEPH W.** See MANNICK, JOHN A.

**FERROUS SULFATE**

—relative biological efficiency of 20 MeV and 4 MeV radiations. Report from Medical Research Council Group, Christie Hospital, Manchester 20 (England), III. The oxidation of ferrous sulfate solution (ab), W. M. Dale et al., March, 530

**FERTILITY.** See Fecundity

**FETUS**  
 See also Embryo; Monsters  
 —comparative effects of prenatal gamma radiation and x-irradiation on reproductive system of rat (ab), Benjamin H. Ershoff and Ved Brat, March, 530

—effects of prenatal radiation on postnatal development in rats (ab), R. L. Murphree and H. B. Pace, June, 996

—fetal tolerance to radiation: case, Alvaro Ronderos, March, 454

—massive neonatal ascites, Olga M. Baghdassarian, P. Ruben Koehler and Gunter Schultz, April, 586

—radiologic considerations of the perinatal distress syndrome, Edward B. Singleton, Harvey M. Rosenberg and Luis Samper, Feb., 200

—transfer of strontium 90 from mother to fetus in mice (ab), Bo Holmberg et al., May, 861

—transfer of zinc 65 across the placenta and fetal membranes of the rabbit (ab), Carolyn W. Terry et al., Feb., 346

**death of**  
 —unequivocal radiological evidence of intra-uterine fetal death, including demonstration of gas formation within fetal circulation: report of case and review of 37 cases of fetal death (ab), Robert Bennett, May, 854

**FIBRIN.** See Blood, fibrin

**FIBROELASTOSIS, ENDOCARDIAL.** See Heart, endocardial fibroelastosis

**FIBROMA.** See Tumors, fibroma

**FIBROMATOSIS.** See Tumors, fibroma

**FIBROSIS.** See Lungs, fibrosis

**FIBULA**  
 —talar-tilt angle and fibular collateral ligaments: method for determination of talar tilt (ab), Gustav Rubin and Morris Witten, Jan., 161

**FIEHRING, H. S., and HERBST, M.**

**FIELD, E. O.** See HOWARD, N.

**FIELDS, T., CLAYTON, G., and KENSKI, J.** New simple radiation scanning system, Jan., 122

**FIESCHI, A., PANNACIULLI, L., and TIZIANELLO, A.** The use of  $^{57}$ Cr labelled red blood cells in the study of splenomegaly and the seats of haemocathexis (ab), May, 559

**FILMS.** See Roentgen Rays, films; Roentgenograms

**FILTERS.** See Larynx, cancer. Radioisotope radiocobalt

**FINBY, NATHANIEL.** See STEINBERG, ISRAEL

**FINKELSTEIN, ARTHUR.** See FINKELSTEIN, LEAH SHORE

**FINKELSTEIN, LEAH SHORE.** See FINKELSTEIN, ARTHUR, and STEIN, GEORGE N.: Carcinoma complicating chronic ulcerative colitis (ab), Feb., 324

**FISCHER, HARRY W.** The big duodenum (ab), April, 677

**FISHER, BERNARD.** See FEDOR, E. J.

**FISHER, DON L.** See BRENT, LAWRENCE B.

**FISHER, W.** See GLAD, B. W.

**FISTULA**  
 —arteriovenous  
 —coronary arteriovenous fistula into main pulmonary artery: preoperative diagnosis by selective aortography (ab), Kurt Amplatz et al., Feb., 319

**esophageal**  
 —importance of radiographic examination of esophagus and routine chest radiography after esophagoscopy (ab), George Cohen and Joseph Katz, Feb., 320

**gastrocolic**  
 —roentgenologic diagnosis of gastrocolic and gastrojejunocolic fistulas (ab), Robert H. Theony et al., April, 677

**gastrojejunocolic**  
 —roentgenologic diagnosis of gastrocolic and gastrojejunocolic fistulas (ab), Robert H. Theony et al., April, 677

**FLAHERTY, ROBERT A., and KEEGAN, JAMES M.** Infra-pulmonary pleural effusion (ab), May, 842

**FLESHER, A. M.** See HALEY, THOMAS J.

**FLETCHER, GILBERT H., MACCOMB, WILLIAM S., and BRAUN, ERNEST J.** Analysis of sites and causes of treatment failures in squamous cell carcinomas of the oral cavity (ab), Feb., 336

**FLINK, E.** See VOGEL, K.-H.

**FLOCH, MARTIN H., and GEFFEN, ABRAHAM:** Intravenous cholangiography with sodium iodipamide: the problem of nonvisualization (ab), March, 511

**FLOYD, JOHN C., Jr., BEIERWALTES, WILLIAM H., DODDSON, VERNON N., and CARR, EDWARD A., Jr.:** Defective iodination of tyrosine a cause of nodular goiter? (ab), April, 592

**FLOYD, ROSS.** See DYKE, W. P.

**FLUIDS**  
—non-strangulating distal ileal obstruction. Part I. The role of hydration. An experimental study correlating pathologic and radiologic findings, Robert D. Sloan, Joseph W. Brock and William M. Fant, March, 407

**FLUORESCENCE**  
—comparison of two fluorometers designed to measure radiation-induced fluorescence of silver-activated glass rods, Nathaniel F. Barr, Mary Stark and J. S. Laughlin, Jan., 113

**FLUORIDES**  
—environmental bone disease (closely related to fluorosis) of hitherto undescribed type (ab), N. F. Dodd et al, May, 850  
radiative. See Radioactivity, radiofluoride

**FLUOROGRAPHY.** See Cranium, roentgenography; Roentgen Ray fluoroscopy

**FLUOROSCOPIC** See Fluorescence

**FLUOROSCOPY.** See Roentgen Rays, fluoroscopy

**FOCAL SPOT IMAGE.** See Roentgen Rays, apparatus

**FOCHT, ELIZABETH F., MERRIAM, GEORGE R., Jr., BARNES, MARY, and EVANS, JOHN A.:** Dose to the eye from radiographic procedures, March, 459

**FODDER**  
—investigation on strontium-90 content of fodder and milk (ab), Ekkehard Gross, March, 527

**FOLSON, T. R., CRAMER, R. A., and MOHANRAO, G. J.:** Radiological physics at an oceanographic institution, Jan., 121

**FOMON, JOHN H., KURZWEG, FRANK T., and DAVIS, HAROLD:** Single dosage x-ray radiation to the lung and posterior mediastinum through the open chest. II. Results in animals receiving a dose of 5,000 r (ab), Feb., 348

**FONTANA, ROBERT S.** See NADEAU, PIERRE J.

**FORAMEN OPTIC.** See Optic Canal

**FORD, LEE T.** See LANSCHE, W. EDWARD

**FOREIGN BODIES**  
See also Cardiovascular System; Eyes  
in air and food passage  
—observations on 100 cases of bronchial foreign body (ab), Dezsö Kassai, March, 490

**FORRESTER, HENRY C., and SOULE, A. BRADLEY:** The value of routine lateral rectal projection in barium enema study (ab), March, 508

**FORSYTHE, H. FRANCIS.** See WHITLEY, JOSEPH E.

**FORSYTHE, THOMAS.** See VARGAS, LESTER L.

**FOSTER, JOHN H., EKMAN, CARL-AXEL, and SCOTT, H. WILLIAM, Jr.:** Late behavior of vascular substitutes: three to five year follow up of arterial homografts and synthetic prostheses in experimental animals (ab), May, 847

**FÖTL, M.:** A new method for roentgen examination of the fornix and the cardial region of the stomach (double contrast examination with spray) (ab), April, 675

**FOUCHÉ, R. F., and D'SILVA, J. L.:** Hypertranslucency of one lung field and its experimental production by unilateral milinary embolisation of pulmonary arteries in cats (ab), March, 501

**SPEARS, J. R., and OGILVIE, COLIN:** Unilateral emphysema (ab), Feb., 314

**FOWLER, J. F.:** Technical procedures of radiodiagnostic interest. A symposium. I. The fundamental limits of information content in solid state image intensifying panels compared with other intensifying systems (ab), April, 686

**FOX, J. DEWITT.** See PONKA, JOSEPH L.

**FRACTURES**  
See also Atlas and Axis; Femur; Humerus; Orbit; Scaphoid Bone; Carpal; Wrist  
stress. See Patella

**FRAIMOW, WILLIAM, CATHCART, RICHARD T., KIRSHNER, J. J., and TAYLOR, RICHARD C.:** Pulmonary alveolar proteinosis. A correlation of pathological and physiological findings in a patient followed up with serial biopsies of the lung (ab), Feb., 317

**CATHCART, RICHARD T., and TAYLOR, RICHARD C.:** Physiologic and clinical aspects of pulmonary alveolar proteinosis (ab), April, 661

**FRANK, HOWARD A.** See BELLMAN, SVEN

—See WILLIAMS, JOHN A.

**FRANKEL, M.** See WEINBERG, H.

**FRANSMAN, S. L.** See ROTA, ALEXANDER N.

**FRASER, W. D.** See BLONDAL, H.

**FREEDLANDER, SAMUEL O.** See HOFFMAN, HENRY L.

**FREEDMAN LECTURES.** University of Cincinnati, April, 650

**FREEMAN, SUMNER L.** See HEMLEY, SAMUEL D.

**FREINKE, NORBERT.** See DOWLING, J. THOMAS

**FRIEDELL, HYMER L.** See STORASIL, JOHN P.

**FRIEDBERG, MARVIN J.** See CARRAS, ROBERT

**FRIEDBERG, RICHARD M., and NEY, CHARLES:** The radiographic findings in neurogenic bladder, May, 795

—and SAYEGH, VICTOR: Advanced skeletal changes in hyperparathyroidism (ab), Feb., 328

—SAYEGH, VICTOR, and SCHULZ, R. J.: A statistical comparison of Orabilex and Telepaque (ab), April, 680

—SHAPIRO, JEROME H., RUBINSTEIN, BERTA M., ROSENZWEIG, MURRAY J., SIEGELAUB, A. B. A., and GANTER, E. LAWRENCE: Measurement of the anterior cerebral artery in normal and abnormal cerebral arteriograms (ab), June, 984

**FRIEDMAN, MILTON,** and PURKAYASTHA, MANISH C.: Recurrent seminoma: the management of late metastasis, recurrence or a second primary tumor (ab), Jan., 169

**FT-9045.** See Cancer therapy

**FUNKQUIST, B., and OBEL, N.:** Tonic muscle spasms and blood pressure changes following the subarachnoid injection of contrast media. An experimental study in dogs with injection of Kontrast U and mixtures of Kontrast U and Xylocaine (ab), April, 687

**FURST, WILLIAM E., BELL, BERTRAND M., and IRONS, GEORGE V., Jr.:** Asymptomatic pulmonary alveolar proteinosis (ab), Feb., 317

**FUSON, ROGER B.** See PLENK, HENRY P.

**G**

**GABRILOVE, J. L.** See IANNACONE, A.

**GAGE, ROBERT P.** See HUPPLER, EDWARD G.

**GALE, NOEL H., and INNES, G. S.:** The advantages of employing mixed high energy x-ray and electron beams in radiation therapy (ab), May, 857

**GALLBLADDER**  
—chemical demonstration of contrast medium precipitate in human gallbladders (ab), Georg Theander and Sten Veige, May, 849

calculi  
—recent experiences with spontaneously disappearing gallstones (ab), Harvey J. Dworkin, March, 510

x-ray negative dyspepsia: follow-up study (ab), Pekka Brummer and Ilkka Häkinen, Jan., 153

excision  
—use of radioactive iodine labeled triolein in evaluation of fat absorption following cholecystectomy (ab), E. J. Fedor and Bernard Fisher, June, 993

**physiology**  
—gallbladder evacuation in normal male induced by cholecystokinin (ab), Paul Edholm, Feb., 326

—roentgenologic study of gallbladder evacuation following nonbiliary tract surgery (ab), Herbert D. Gullick, Feb., 327

**roentgenography**  
—accuracy of routine gallbladder and bile-duct studies (ab), Ward Shaver, March, 509

—cholecystography and cholangiography today (ab), James R. Riley, Jan., 157

—comparative assay of Biligrafin and perorally effective cholangio-cholecystography contrast media (Biloptin and related substances) (ab), H. Ludin and Clara Lauchemauer, Feb., 327

—comparative clinical evaluation of a new oral cholecystographic medium, Orabilex, with Telepaque (ab), J. P. O'Laco and William A. Wilcox, March, 509

—comparative study of Telepaque dosage in cholecystography using single-dose and double-dose techniques (ab), Carl P. Wisoff, Jan., 158

—distended gallbladder: the value of fat meal in cholecystography (ab), Maurice D. Sachs and Philip F. Partington, March, 509

—gastric retention during oral cholecystography due to underlying lesions of stomach and duodenum (ab), P. Ruben Koehler et al, Feb., 323

—historical features of cholecystography. The Carman lecture, Warren H. Cole, March, 354

—intravenous cholecysto-cholangiography in emergency abdominal diagnosis (ab), William G. Meyer, June, 988

—polycystic disease of liver, with unusual cholecystographic manifestations; case (ab), Earl E. Gambill and John R. Hodgson, April, 679

—pseudoconcretions in precipitate of contrast medium in gallbladder (ab), Georg Theander, March, 510

—reliability of Telepaque cholecystography (ab), D. A. Alderson, March, 509

—residual contrast medium in bowel in cholecystography with iopanoic acid and certain related substances (ab), Lars Andrén and Georg Theander, April, 680

—statistical comparison of Orabilex and Telepaque (ab), Richard M. Friedenberg et al, April, 680

—See Bile Ducts, roentgenography; Gallbladder, surgery; excision

**tumors**  
—benign neoplasms of the gallbladder: diagnosis and surgical implications (ab), Seymour F. Ochsner and Alton Ochsner, March, 510

**GALLOWAY, JAMES R., and GREITZ, TORGNY:** The medial and lateral choroid arteries. An anatomic and roentgenographic study (ab), April, 672

**GALLSTONES.** See Gallbladder, calculi

**GAMBILL, EARL E., and HODGSON, JOHN R.:** Polycystic disease of the liver, with unusual cholecystographic manifestations. Report of a case (ab), April, 679

**GAMMA GLOBULIN**  
—gamma globulin concentrations in ambulatory patients with bronchiectasis: survey with report of 1 case of agammaglobulinemia treated for four years (ab), Helen S. Pittman, March, 501

**GAMMA RAYS.** See Neutrons; Radioactivity, apparatus; Radioactivity, radiocesium; Radioactivity, radiocobalt

**GAMMELGÅRD, P. A.** See BRÜNNER, S.

**GANGRENE.** See Stomach, gangrene

**GANNON, WILLIAM E.** False block of the internal carotid artery during angiography, May, 748

**GANTER, E. LAWRENCE.** See FRIEDENBERG, RICHARD M.

**GARCIA, ANTONIO M.** See STRAFFON, RALPH A.

**GARCIA, JOHN, and KIMELDORF, DONALD J.** Some factors which influence radiation-conditioned behavior of rats (ab), June, 996

—See KIMELDORF, D. J.

**GARCIA, NICHOLAS A., III.** See LUND, RONALD R.

**GARCIA, ROBERT C.** See GOLD, JEROME A.

**GARRETT, ROBERT A., and KLATTE, EUGENE C.** Cineurography (ab), Feb., 332

**GARSTEN, PER.** See CARLSSON, ERIK

**GARTENLAUB, C.** See LUND, RONALD R.

**GARTNER'S DUCTS**  
—radiographic demonstration of Gartner's ducts (ab), W. J. Weston, June, 989

**GARUSI, G. F.** Collateral circulations in obstructive syndromes of the superior vena cava and its larger branches (ab), April, 668

**GARVER, RICHARD M.** See COLE, LEONARD J.

—See SANTOS, GEORGE W.

**GAS.** See Carbon Dioxide

**GASIOROWSKI, M.** See PIERQUIN, B.

**GASTINEAU, DAVID C.** See GWINN, JOHN L.

**GASTRECTOMY.** See Peptic Ulcer, surgical therapy; Stomach, surgery

**GASTROENTEROSTOMY.** See Peptic Ulcer, surgical therapy

**GASTROINTESTINAL TRACT**  
See also Colon; Intestines; Stomach  
—employment of ion-exchange resins for removal of plutonium from the gastrointestinal tract (ab), V. A. Belyaev, Feb., 346

**CANCER**  
—late involvement of alimentary tract by carcinoma of kidney (ab), Mansho T. Khilnani and Bernard S. Wolf, April, 679

—osteoblastic bone metastases in gastrointestinal and bronchial carcinoid (ab), Frances B. Toomey and Benjamin Felson, Feb., 329

**DISEASES**  
—use of cineradiography in routine diagnosis of disease of upper gastrointestinal tract; experience in 1,000 cases (ab), Joseph Jorgens et al., April, 675

**effects of irradiation**  
—radiation-induced gastrointestinal death in the monkey (ab), Stephen G. Wilson, Jr., Feb., 348

**hemorrhage**  
—evaluation of Einhorn string test (ab), J. A. Ewart et al., May, 848

**necrosis**  
—necrosis of entire gastrointestinal tract following translumbar aortography (ab), Robert J. Wilder and Felicien M. Steichen, Jan., 149

**obstruction**  
—water-soluble contrast media: their use in diagnosis of obstructive gastrointestinal disease (ab), Robert J. Rubin et al., Jan., 152

**GASUL, BENJAMIN M.** See LUAN, LAWRENCE L.

—See LYNNFIELD, JOSHUA

**GAUTEREAUX, M. E.** See BACHOFER, C. S.

**GAUTHIER, G.** Symptomatology and neuroradiologic diagnosis of parasagittal meningioma (ab), Feb., 312

**GEARING, FRANK W., Jr., and CANTER, N. M., Jr.** The oral cholangiogram (ab), Feb., 327

**GEEVER, ERVING E.** See HARDY, RICHARD W.

**GEFFEN, ABRAHAM.** See FLOCH, MARTIN H.

**GENEST, J.** See PIGEON, G.

**GENITALS**  
See also under names of genital organs  
—betastron therapy of gynecologic cancers (ab), Gerhard Schubert et al., March, 529

**GERE, J. BRYCE.** See EDMONDSON, WILLIAM R.

**GERSHON-COHEN, J.** See GRIFFITH, M. G.

**GERSTNER, HERBERT B.** See LEVIN, WILLIAM C.

**GHOSE, SANDHYA, and CHATTERJEE, J. B.** Chronic myeloid leukemia: a study of 116 cases (ab), March, 522

**GHOSE, TARUNENDU.** See HEYSEL, ROBERT

**GIANT-CELL TUMORS.** See Tumors, giant-cell

**GIBB, ROBERT.** Some clinical aspects of megavoltage. Seminoma of the testis (ab), Feb., 339

**GIBBON, NORMAN.** See ROSS, J. COSBIE

**GILDENHORN, HYMAN L.** GILDENHORN, VIVIAN B., and AMROMIN, GEORGE: Marrow embolism and intrasosseous contrast radiography (ab), April, 684

**GILDENHORN, VIVIAN B.** See GILDENHORN, HYMAN L.

**GLAD, B. W., MAYS, C. W., and FISHER, W.** Strontium studies in beagles (ab), June, 995

**GLASS RODS.** See Dosimeters and Dosimetry

**GLENN, JAMES F., and HARVARD, B. MARVIN.** The injured kidney (ab), April, 684

**GLENN, W. L.** See HUME, MICHAEL

**GLUCOSE**  
—alteration in glucose tolerance produced by irradiation of pelvis (ab), Lilia Lopez Borja et al., Feb., 347

**GLUTATHIONE**  
—protective effects on fecundity and fertility from feeding cysteine and glutathione to *Hybomitra* females before x-irradiation (ab), Daniel S. Grosch, May, 866

**GLUTEN**  
—effect of corticosteroids and gluten-free diet on absorption of iron in idiopathic steatorrhea and celiac disease (ab), John Badenoch and Sheila T. Callender, June, 994

**GOIDANICH, I. F.** See MUCCHI, L.

**GOITER**  
See also Goiter, Exophthalmic; Thyroid  
—defective iodination of tyrosine a cause of nodular goiter (ab), John C. Floyd, Jr., et al., April, 692

—treatment of toxic nodular goiter with radioactive iodine: 10 years experience with 436 cases (ab), Milton Eller et al., April, 692

**intrathoracic**  
—goiter plongeant: intrathoracic goiter demonstrated by Val-salva maneuver (ab), Henry T. Perkins, Jr., et al., Jan., 143

**plongeant.** See Goiter, intrathoracic

**GOITER, EXOPHTHALMIC**  
See also Thyroid  
—effect of methythiouracil and iodide on iodinated constituents of thyroid tissue in Graves' disease (ab), E. Yamazaki et al., April, 692

—metabolism of triiodothyronine in Graves' disease (ab), Ian B. Hales and Brown M. Dobyns, Jan., 171

—remission of Graves' disease following radiotherapy of pituitary neoplasm (ab), Joseph W. Jailer and Donald A. Holub, Feb., 338

**GOITROGENS**  
—action of various goitrogens in inhibiting localization of radioactive iodine in thyroid and thymus glands of larval tree toads (ab), W. Gardner Lynn and James N. Dent, April, 693

**GOLD.** See Radioactivity, radiogold

**GOLD, JEROME A., GARCIA, ROBERT C., and DAVIS, JOHN W.** The effect of intravenous paradehyde as recorded by the chest x-ray film. A case report (ab), April, 663

**GOLDBERG, HARRY.** See DESHMUKH, MADHUKAR

**GOLDBERG, MINNIE B.** See SHELINE, GLENN E.

**GOLDBLOOM, RICHARD B.** See DUNBAR, J. SCOTT

**GOLDEN, RICHARD L., and BERTRAND, CHARLES A.** "Snowman" heart. Manifestation of total anomalous pulmonary venous connection (ab), April, 665

**GOLDENBERG, ERWIN D.** See TENG, PAUL

**GOLDENBERG, GERALD J., and GREENSPAN, RICHARD H.** Middle-lobe atelectasis due to endobronchial sarcoidosis, with hypercalcemia and renal impairment (ab), April, 662

**GOLDSCHLAG, H.** Serious thyrotoxic crisis after therapeutic dose of  $I^{131}$  (ab), Feb., 343

**GONADS**  
See also Ovary; Testes  
—comparative effects of prenatal gamma radiation and x-irradiation on reproductive system of rat (ab), Benjamin H. Ershoff and Ved Brat, March, 530

—deformity of medial tibial condyle in 19 cases of gonadal dysgenesis (ab), Jerzy Kosowicz, April, 683

—gonadal dosage in pediatric radiotherapy, John L. Gwin, David C. Gastineau and John A. Campbell, June, 881

—gonadal exposure incident to roentgen therapy, Gustave Kaplan, Carl Collica and Sidney Rubenfeld, June, 877

—mutation as cause of death in offspring of irradiated rats (ab), J. F. McGregor et al., April, 700

—universal gonadal shield (ab), Enrique Schwarz et al., June, 995

**GONDOS, BELA.** Rotation of the kidney around its longitudinal axis, April, 615

**GOOD, C. ALLEN, and HOLMAN, COLIN B.** Cavitary carcinoma of the lung: roentgenologic features in 19 cases (ab), Jan., 146

—See BERKSON, JOSEPH

**GOODALL-COPESTAKE, GERALD.** See LEFCOE, NEVILLE M.

**GOODLIN, ROBERT C., GREENSPAN, RICHARD, and BERNSTEIN, EUGENE F.** Intravenous placental photography (ab), June, 989

**GOODMAN, JOAN WRIGHT, and OWEN, RAY D.** Red cell regeneration in irradiated mice treated with plethoric homologous bone marrow (ab), Feb., 349

**GOODNER, JOHN T.** See CLIFFTON, EUGENE E.

**GORDON, GERALD S.** See BRETTELL, HERBERT R.

**GORLERO ARMAS, A.** See LOCKHART, JORGE

**GOULD, DAVID M.** (obit), June, 976

**GOULD, JOHN, and TOFFLER, ALLAN H.** Duplication of the stomach. A case report, May, 790

—See WALLACE, SIDNEY

**GRADIENT ANALYZER.** See Counters and Counting

**GRAHAM, DONALD C.** Leukemia following x-ray therapy for ankylosing spondylitis (ab), April, 696

**GRAHAM, JOHN B., and GRAHAM, RUTH M.** The sensitization response in patients with cancer of the uterine cervix (ab), April, 690

—See BORJA, LILIA LOPEZ

**GRAHAM, RUTH M.** Cytologic prognosis in cancer of the cervix (ab), March, 521

—See GRAHAM, JOHN B.

**GRANULOMA, EOSINOPHILIC.** See Bladder, tumors; Bones, tumors

**GRAVES' DISEASE.** See Goiter, Exophthalmic

GRAY, DONALD D. See CAMPBELL, JOHN A.

GRAYHACK, JOHN T. See HOFFMAN, WILLIAM W.

GREEN, PAUL A., and WOLLAEGER, ERIC E.: The clinical behavior of sprue in the United States (ab), Feb., 324

GREENBERG, BENJAMIN E.: Epidermoid cyst of the skull. A case observed for sixteen years, Jan., 107

GREENE, DAVID, and MASSEY, JOHN B.: The relative biological efficiency of 20 Mrad and 4 Mrad radiations. A report from the Medical Research Council Group, Christie Hospital, Manchester 20 (England). II. Physical aspects (ab), March, 530

—See DALE, W. M.

GREENING, J. R. See PROCTER, N. M.

GREENING, ROY R. See WALLACE, SIDNEY

GREENSPAN, RICHARD H., BERNSTEIN, EUGENE F., and LÖKEN, MERLE K.: Intravenous aortography. Technique and clinical aspects (ab), April, 667

—See GOLDENBERG, GERALD J.

—See GOODLAM, ROBERT C.

GREENSPAN, EDWARD A., and LENTINO, WALTER: Retrograde aortography. A new method for the roentgenologic study of the small bowel (ab), March, 506

GREENWOOD, WILLIAM F. See ALDRIDGE, HAROLD E.

GREGG, ANTON. See POPPE, HANNO

GREIFF, DONALD, POWERS, E. L., KISIELESKI, WALTER E., and PINKERTON, HENRY: The effects of x-rays and beta rays (tritium) on the growth of Rickettsia moose and Rickettsia akari in embryonated eggs (ab), April, 700

GREITZ, TORGNY. See GALLOWAY, JAMES R.

GRID THERAPY. See Electrons

GRIFFITH, J. Q., Jr. See GRIFFITH, M. G.

GRIFFITH, M. G., GRIFFITH, J. Q., Jr., HERMEL, M. B., and GERSHON-COHEN, J.: Effect of irradiation to adenra upon circulating adrenal cortical hormone in the rat, Jan., 110

GRILLO, THEOPH. See HUME, MICHAEL

GRISCOM, NATHAN T. See POTSAID, MAJIC S.

GROSS, EKKEHARD: Investigations on the strontium-90 content of fodder and milk (ab), March, 527

GROSCH, DANIEL S.: Protective effects on fecundity and fertility from feeding cysteine and glutathione to Habrobracon females before x-irradiation (ab), May, 866

GROSS, KENNETH E. See SANDERSON, STEVENS S.

GRUNDHAUSER, F. J. See DYKE, W. P.

GRUPP, ERICA. See RUGH, ROBERTS

di GUGLIELMO, L.: Angiographic findings in coronary sclerosis (ab), Feb., 319

—BALDRIGHI, V., MONTEMARTINI, C., and SCHIFINO, A.: Roentgen investigation of the coronary veins in the dog (ab), Jan., 150

—and TRENTA, A.: A new radiologic sign of myocardial infarct (ab), March, 501

GUSS, LEWIS W.: A 5-year follow-up of roentgenographically detected lung cancer suspects (ab), April, 661

—and KUENSTLER, PATRICIA: A retrospective view of survey photofluorograms of persons with lung cancer (ab), April, 661

—and MACDONALD, IAN: End results and causes of failure in treatment of intralobar carcinoma (ab), Feb., 337

GULLICK, HERBERT D.: A roentgenologic study of gallbladder evacuation following nonbiliary tract surgery (ab), Feb., 327

GUTTMANN, RUTH J.: Comparison of three different methods of external irradiation, and their results, in the treatment of inoperable carcinoma of the lung, Jan., 83

GUVCEN, SULAHATTIN. See DESHMUKH, MADHUKAR

GWINN, JOHN L., GASTINEAU, DAVID C., and CAMPBELL, JOHN A.: Gonadal dosage in pediatric radiotherapy, June, 881

GYNECOLOGY

See also Pelvis, blood supply; Uterus, cancer; etc.

—betatron therapy of gynecologic cancers (ab), Gerhard Schubert et al., March, 520

GYORKOVICZ, JOSEPH, and POLLOCK, FREDERIC J.: Radiation necrosis of the osseous (ab), March, 527

GYPSUM PLASTER

—conventional building materials as protective radiation barriers, E. Dale Trout, John P. Kelley and Arthur C. Lucas, Feb., 237

**H**

HACKENTHAL, PETER: The palliative irradiation of bronchial carcinoma (ab), Jan., 166

HÄKKINEN, ILKKA. See BRUMMER, PEKKA

HAGEDORN, ALBERT B. See BONNET, JOHN D.

—See CAWEIN, MADISON J., III

HAIMOVICI, HENRY, SHAPIRO, JEROME H., and JACOBSON, HAROLD G.: Serial femoral arteriography in occlusive disease. Clinical roentgenologic considerations with a new classification of occlusive patterns (ab), April, 670

HAIR follicles

—DNA synthesis in irradiated hair follicles of mouse (ab), S. M. Cattaneo et al., June, 997

HALE, JOHN. See LEWIS, GEORGE C., Jr.

HALES, IAN B., and DOBYNS, BROWN M.: The metabolism of triiodothyronine in Graves' disease (ab), Jan., 171

—See CURRENT, JAMES V.

HALEY, THOMAS J., LINDBERG, R. G., FLESHER, A. M., RAYMOND, E., MCKIBBEN, W., and HAYDEN, PAGE: The response of the kangaroo rat (*Dipodomys merriami* Mearns) to single whole-body x-irradiation (ab), April, 701

HALF-VALUE LAYER. See Roentgen Rays, physics

HALL, JACK H. See WILLIAMS, JOHN A.

HAMILTON, J. GREGORY. See ZEIT, PAUL R.

HAMM, FRANK C., WATERHOUSE, KEITH, and WEINBERG, SIDNEY R.: Dangers of excretory urography (ab), Jan., 164

HAMMOND, CAROLYN W. See MILLER, C. PHILLIP

HANAPEE, WILLIAM. See PIERCE, FRANK T., Jr.

HANSEN, POUL BJERRE, and HAUG, AGNER: Treatment of pleural and peritoneal carcinomatous effusions with radioactive gold (1956-1959) (ab), Feb., 345

HARDIN, CREIGHTON A., and AGNEW, COLVIN H.: Chronic gastritis volvulus: symptoms of epigastric pain and emesis (ab), Feb., 321

HARDY, RICHARD W., PERALES, LUIS A., BOUGHTON, GEOFFREY A., GEEVER, ERVING F., SHERMAN, ROGER T., and MONCRIEF, WILLIAM H., Jr.: The effect of whole-body radiation and infection on arterial replacement (ab), Feb., 350

HARPER, R. A. KEMP: Radiology in the diagnosis of retroperitoneal tumours (ab), Feb., 335

HARRIS, LLOYD E., LIPSCOMB, PAUL R., and HODGSON, JOHN R.: Early diagnosis of congenital dysplasia and congenital dislocation of the hip. Value of the abduction test (ab), March, 513

HARRIS, M. D. See LOGIE, L. C.

HARRIS, P. F.: Quantitative studies of bone-marrow cells in the early stages of final haemopoietic recovery in irradiated guinea-pigs (ab), Feb., 349

HARRIS, PAYNE S.: Space radiations: natural and man-made. Memorial Fund Lecture, April, 532

HARRISON, EDGAR G., Jr., DIVERTIE, MATTHEW B., and OLSEN, ARTHUR M.: Pulmonary alveolar proteinosis. Report of case with fatal outcome (ab), March, 498

—See NADEAU, PIERRE J.

HARRISON, F. See TRACY, G. D.

HARTLEB, O. See HERBST, M.

HARTWEG, H.: Roentgen findings in the thorax in the chronic leukoses (ab), March, 500

HARVARD, B. MARVIN. See GLENN, JAMES F.

HASEGAWA, JUNJI, and IHRKE, ROYAL E.: Tuberous sclerosis complex. Unusual case of adenoma sebaceum, tuberous sclerosis, and extensive bone lesions (ab), March, 512

HASHIMOTO'S DISEASE. See Thyroid, diseases

HAUG, AGNER. See HANSEN, POUL BJERRE

HAWKINS, A. See VULPE, M.

HAWKINSON, HARLAN W. See JORGENSEN, JOSEPH

HAWLICZEK, F., LANGNER, E., and SEEMANN, D.: Cerebral radioangiography (ab), Jan., 175

HAYDEN, PAGE. See HALEY, THOMAS J.

HAYES, MARK A.: Operative pancreatography (ab), Feb., 325

HAYLES, ALVIN B. See NOLAN, ROBERT B.

HEACOCK, CHARLES HUNTER (obit), March, 484

HEAD. See Cranium

HEAGY, FRED C., and SWARTZ, DONALD P.: Localizing the placenta with radioactive iodinated human serum albumin, June, 936

HEART

See also Cardiovascular System: Pericardium

—radioautography of conduction system of dog's heart with  $I^{131}$  (ab), Herman N. Uhley et al., March, 526

—use of "radiopaque streamers" to show blood currents in heart, T. Doby, June, 968

abnormalities. See also Ductus Arteriosus

—approach to roentgenologic diagnosis of congenital heart disease (ab), Owings W. Kincaid, April, 664

—differential diagnosis of Taussig-Bing heart from complete transposition of great vessels with a posteriorly overriding pulmonary artery (ab), Alois Beuren, May, 843

—differential of interatrial communications by clinical methods: ostium secundum, ostium primum, common atrium, and total anomalous pulmonary venous connection (ab), James W. DuShane et al., Jan., 147

—effect of repeated fluoroscopic examinations on 1,480 children with long-term follow-up study (ab), Ann McA. Birch and David H. Baker, March, 528

—intracardiac injection of radioactive krypton: clinical application of new methods for characterization of circulatory shunts (ab), Robert T. L. Long et al., May, 858

—left retrograde cardioangiography: its diagnostic value in acquired and congenital heart disease, Kurt Amplatz, Richard G. Lester, Richard Ernst and C. Walton Lillehei, March, 393

—obstruction of left ventricular outlet in association with ventricular septal defect (ab), Ronald M. Lauer et al., June, 987

—pulmonary veins in congenital heart disease in the adult, Robert S. Ormond, Andrew K. Poznanski and Arch W. Templeton, June, 883

—roentgenologic diagnosis of congenitally corrected transposition of great vessels (ab), Richard G. Lester et al., April, 666

—selection for surgery of patients with ventricular septal defect and pulmonary hypertension (ab), James W. DuShane and John W. Kirklin, Jan., 148

**HEART, abnormalities**—*cont.*  
 —surgical correction of aortic insufficiency associated with ventricular septal defect (ab), Albert Starr et al, May, 843  
**blood supply**  
 —measurement of myocardial blood flow: radioisotope techniques used in patients with normal and arteriosclerotic hearts after infarction (ab), Philip C. Johnson and Gunnar Sevelius, May, 857  
**catheterization**. See also Heart, endocardial fibroelastosis  
 —left ventricular and systemic arterial catheterization: simple percutaneous method using a spring guide (ab), Charles T. Dotter, April, 671  
 —mitral valvular stenosis: clinical and hemodynamic study of 11 cases (ab), Stephen M. Ayres and Daniel S. Lukas, April, 669  
 —stenosis of right main pulmonary artery. Clinical, angiographic, and catheterization findings in 10 patients (ab), Lawrence L. Luan et al, May, 844  
**dilatation**  
 —percussion of sternum. I. Aid to differentiation of pericardial effusion and cardiac dilatation (ab), William Dressler, 666  
**diseases**. See also Heart, abnormalities; Heart, endocardial fibroelastosis  
 —familial muscular subaortic stenosis: an unrecognized form of "idiopathic heart disease," with clinical and autopsy observations (ab), Lawrence B. Brent et al, Feb., 318  
**effects of irradiation**  
 —effect of radiation upon heart (ab), Mary Catterall, Jan., 176  
 —effects of intensive radiation on human heart, Jerome M. Vaeth, Lawrence Z. Feigenbaum and Malcolm D. Merrill, May, 755  
 —effects of radiations on heart (ab), Arthur Jones and John Wedgwood, Jan., 175  
 —effects of x-irradiation on embryos at critical stages of heart development (ab), W. M. Copenhagen et al, April, 699  
 —myocardial injury from therapeutic irradiation (ab), Mary Catterall and William Evans, April, 696  
**electrocardiography**  
 —intercalated angiography: cardiovascular spot-filming, Robert J. Boucek, William P. Murphy, Jr., and Francisco A. Hernandez, April, 565  
**endocardial fibroelastosis**  
 —right and left heart catheterization and angiographic findings in idiopathic cardiac hypertrophy with endocardial fibroelastosis (ab), Joshua Lynfield et al, Jan., 147  
 failure. See Heart, insufficiency  
**hypertrophy**  
 —right and left heart catheterization and angiographic findings in idiopathic cardiac hypertrophy with endocardial fibroelastosis (ab), Joshua Lynfield et al, Jan., 147  
**infarction**  
 — $^{131}$ I triolein tolerance curves in patients with diabetes mellitus: their similarity to those observed in myocardial infarction (ab), Herschel Sandberg et al, April, 693  
 —measurement of myocardial blood flow: radioisotope techniques used in patients with normal and arteriosclerotic hearts after infarction (ab), Philip C. Johnson and Gunnar Sevelius, May, 857  
 —new radiologic sign of myocardial infarct (ab), L. di Guglielmo and A. Trenta, March, 501  
**injection into**. See Heart, abnormalities  
**insufficiency**  
 —studies with chlorothiazide tagged with radioactive carbon ( $C^{14}$ ) in human beings (ab), Herbert R. Brettell et al, May, 858  
**pressure in**. See Blood Pressure, intracardiac  
**puncture**  
 —"B" lines of Kerley and left atrial size in mitral valve disease: their correlation with mean left atrial pressure as measured by left atrial puncture, R. E. Melhem, J. D. Dunbar and R. W. Booth, Jan., 65  
**roentgenography**. See also other subheads under Heart  
 —routine cardiac fluoroscopy—an unnecessary health hazard (ab), Eliot Corday and Henry Jaffe, Jan., 176  
**size**. See also Heart, dilatation; Heart, hypertrophy  
 —transverse diameter of heart in older people (ab), Nairn R. Cowan, April, 664  
**tumors**  
 —myxoma of left atrium (ab), Harold E. Aldridge and William F. Greenwood, April, 665  
 —right atrial myxoma: diagnosis during life; successful surgical removal (ab), Hyman Ashman et al, Feb., 318  
**valves**. See also Aortic Valve; Mitral Valve; Pulmonary Valve  
 —left retrograde cardioangiography: its diagnostic value in acquired and congenital heart disease, Kurt Amplatz, Richard G. Lester, Richard Ernst and C. Walton Lillehei, March, 393  
**HEATLEY, JOHN EVANS** (obit), March, 485  
**HEIER, A. J.** See VERLOOP, M. C.  
**HEIMLICH, HENRY J.** See LUST, FRANZ J.  
**HEITZMAN, E. ROBERT, and BERNE, ALFRED S.**: Roentgen examination of the cecum and proximal ascending colon with ingested barium, March, 415  
 —and PERCHIK, LAWRENCE: Radiographic features of renal infarction. Review of 13 cases, Jan., 39  
**HELANDER, C. G., and LINDBOM, Å.**: Varicose of the broad ligament. A venographic study (ab), Jan., 163  
**HELLRIEGEL, WERNER**: Clinical picture and prospect of cure of malignant melanoma (ab), April, 688  
**HELLSTRÖM, LARS**. See JONSSON, GUNNAR  
**HEMANGIOPERICYTOMA**. See Tumors, hemangiopericytoma  
**HEMATOMA**. See Intestines, hematoma  
**HEMLEY, SAMUEL D., ARIDA, EDWARD J., DIGGS, A. MONROE, and FREEMAN, SUMNER L.**: Percutaneous cricothyroid membrane bronchography, May, 763. See also correction, June, 980  
 —**ARIDA, EDWARD J., and RING, EDWARD M.**: The renal arteries: an evaluation of roentgen methods of opacification, March, 402  
**HEMOCATHARTESIS**. See Erythrocytes, destruction  
**HEMOLYSIS**  
 —radioactive iron studies in patients with iron-deficiency anemia with concurrent abnormal hemolysis (ab), M. C. Verloop et al, June, 994  
**HEMOPOIETIC SYSTEM**  
 See also Bones, marrow; Leukemia; Spleen  
 —effects of protracted irradiation on blood-forming organs of rat. Part I. Continuous exposure (ab), L. F. Lamerton et al, March, 528  
 —experimental hemopoietic replacement: possible use in radiotherapy (ab), Peter Ilbery, April, 691  
 —malabsorption syndromes: a symposium. III. Hematological diagnosis of addisonian pernicious anemia and the intestinal malabsorption syndrome (ab), D. L. Mollin, April, 678  
 —quantitative studies of bone-marrow cells in early stages of final hemopoietic recovery in irradiated guinea-pigs (ab), P. F. Harris, Feb., 349  
**HEMORRHAGE**  
 See also Gastrointestinal Tract; Kidneys  
 —subarachnoid. See Meninges, hemorrhage  
**HENDERSON, S. T.**: Technical procedures of radiodiagnostic interest. A symposium. II. The prospects for solid state intensifying screens (ab), April, 686  
**HENDRICKSE, R. G., and COLLARD, PATRICK**: Salmonella osteitis in Nigerian children (ab), May, 851  
**HENEGER, GEORGE C.** See STARZL, T. E.  
**HENEL, DORA K.** See KLIGERMAN, MORTON M.  
**HENNY, GEORGE C.** See STAUFFER, HERBERT M.  
**HENRARD, E. H.** See ARIANOFF, A. A.  
**HENZL, M., HORSKY, J., PRESL, J., and VALENTE, M.**: Pneumopelvigraphy of developmental malformations of the female internal genitalia (ab), Jan., 162  
**HEPATOGRAPHY**. See Liver, function tests  
**HERBST, M., BOCK, K., HARTLER, O., and FIEHRING, H.**: Supravalvular aortic stenosis with hypoplasia of the aorta (ab), March, 502  
**HERION, JOHN C.** See JOHNSON, PHILIP M.  
**HERMEL, M. B.** See GRIFFITH, M. G.  
**HERNANDEZ, FRANCISCO A.** See BOUCEK, ROBERT J.  
**HERNIA**  
 See also Stomach, hernia  
 —diaphragmatic  
 —clinical significance of roentgenological hiatus hernia (ab), T. Vartio et al, Jan., 158  
 —lipoid pneumonia associated with paraesophageal hernia: angiographic study of case (ab), Israel Steinberg, Jan., 145  
 —strangulated diaphragmatic hernia complicated by gangrene of stomach (ab), Lawrence Braslow et al, Feb., 322  
 —traumatic transthoracic diaphragmatic herniation of stomach (ab), Theodore E. Keats, March, 505  
 —x-ray and clinical features of hiatal hernia: significance of hiatal hernias of minimal degree (ab), Henry J. Tume et al, April, 681  
 —paraesophageal. See Hernia, diaphragmatic  
**HEREDITY**  
 See also Familial Conditions  
 —mechanism  
 —mutation as cause of death in offspring of irradiated rats (ab), J. F. McGregor et al, April, 700  
 —relative biological efficiency of 20 Mrad and 4 Mrad radiations. Report from the Medical Research Council Group, Christie Hospital, Manchester 20 (England). V. Induction of dominant lethal mutations in Drosophila sperm (ab), A. J. Bateman, March, 530  
**HERZMARK, MAURICE H.**: Backache from lumbosacral instability (ab), Feb., 331  
**HERZOG, H.**: Expiratory stenosis of the trachea and main stem bronchi due to a weakened pars membranacea: its treatment by plastic reinforcement (ab), Jan., 146  
**HEYSEL, ROBERT, BRILL, A., BERTRAND, WOODBURY, LOWELL A., NISHIMURA, EDWIN T., GHOSE, TARUNENDU, HOSHINO, TAKASHI, and YAMASAKI, MITSURU**: Leukemia in Hiroshima atomic bomb survivors (ab), Feb., 348  
**HIEMSCH, W.**: Method of roentgenologic functional evaluation of the operated stomach (ab), Feb., 322  
**HILBISH, THEODORE F., and SCHULZ, EMIL**: Roentgenologic manifestations of trophoblastic tumors (ab), Jan., 162  
**HILDING, DAVID A., and TACHDJIAN, MIHRAN O.**: Dysphagia and hypertrophic spurring of the cervical spine (ab), May, 852  
**HINCK, VINCENT C., HOPKINS, CARL E., and SAVARA, BHIM S.**: Diagnostic criteria of basilar impression, April, 572  
**HINSHAW, LERNER B.** See CARLSON, CURTIS H.

**HIP** See also Femur  
**diseases**  
 —steroid arthropathy of hip (ab), D. R. Sweetnam et al., March, 54  
**dislocations**  
 —early diagnosis of congenital dysplasia and congenital dislocation of hip; value of abduction test (ab), Lloyd E. Harris et al., March, 513  
**HISTOCYTOSIS X.** See Reticuloendothelial System  
**HISTOPLASMOSIS**  
 —calcified hilar node: its significance and management; a review (ab), John Storer and Ralph C. Smith, April, 663  
 —chronic active pulmonary histoplasmosis with cavitation: clinical and laboratory study of 13 cases (ab), David F. Loewen et al., Feb., 316  
 —pulmonary aspergillosis with cavitation secondary to histoplasmosis (ab), John J. Procknow and David F. Loewen, May, 841  
**HJORT, G. H.** See DIEPEVEEN, W. P.  
**HOCH, TIM** ROBERT J. See ELLIS, KENT  
**HODGKIN'S DISEASE**  
 —pulmonary manifestations of lymphogranulomatosis (ab), Alberto Banfi, June, 987  
 —simultaneous occurrence of osteitis deformans and Hodgkin's disease (ab), Arthur E. Davis, Jr., March, 512  
 —time-dose relationship in Hodgkin's disease, Ralph M. Scott, Feb., 276  
**HODGSON, CORINN H., CALLAHAN, JOHN A., BRUWER, ANDRE J., and BULBULIAN, ARTHUR H.**: Misleading thoracic roentgenograms. Cardiovascular abnormalities that may simulate diseases of the lungs, bony thorax, or mediastinum (ab), April, 663  
**HODGSON, JOHN R.** See GAMBILL, EARL E.  
 —See HARRIS, LLOYD E.  
 —See THOENY, ROBERT H.  
**HODSON, C. J., and TRICKY, S. E.**: Bronchial wall thickening in asthma (ab), May, 842  
**HOECKER, FRANK E.**: Practical uses for the radiation polymerization dosimeter in radiation therapy, Jan., 116  
**HÖÖK, OLLE, and SALTZMAN, GEORG-FREDRIK**: Bilateral anomalies of the middle cerebral artery in recurrent subarachnoid haemorrhage. Report of a case (ab), Feb., 312  
**HOFFMAN, HENRY L., and FREEDLANDER, SAMUEL O.**: Supradiaphragmatic transposition of the spleen for portal hypertension. An experimental and clinical study (ab), Jan., 151  
**HOFFMAN, WILLIAM W., and GRAYHACK, JOHN T.**: The limitations of the intravenous pyelogram as a test of renal function (ab), Feb., 333  
**HOLESH, S.**: Dissecting aneurysm of the aorta (ab), May, 843  
**HOLMAN, COLIN B.** See GOOD, C. ALLEN  
**HOLMAN, W. P.** See ACKLAND, T. H.  
**HOLMBERG, BO, NELSON, ARNE, and WALLGREN, ELSIE**: The transfer of strontium-90 from mother to fetus in mice (ab), May, 801  
**HOLMES, K. S.**: Some clinical aspects of megavoltage. The treatment of carcinoma of the middle ear by the 4 MV linear accelerator (ab), Feb., 340  
**HOLSTEIN, J., and STECKEN, A.**: Relationship between ulcers in the aged and radiologically demonstrated calcification of the left gastric artery (ab), April, 676  
**HOLTZ, SUMNER, POWERS, WILLIAM E., and SHERMAN, ALFRED I.**: Effect of radiation on metastatic pelvic lymph nodes judged by pelvic venograms, Feb., 287  
**HOLUB, DONALD A.** See JAILER, JOSEPH W.  
**HOLYOKE, JOHN B.** See PARKER, ROBERT G.  
**HOMOGRAFTS.** See Arteries, surgery  
**HOOD, R. MAURICE, and SLOAN, HERBERT E.**: Injuries of the trachea and major bronchi (ab), Feb., 314  
**HOOPER, F. M.**: Radiation hazards in x-ray diagnosis (ab), March, 527  
**HOPKINS, CARL E.** See HINCK, VINCENT C.  
**HORIKAWA, MASAKATSU, and SUGAHARA, TSUTOMU**: Studies on the effects of radiation on living cells in tissue culture. I. Radiosensitivity of various imaginal discs and organs in larvae of *Drosophila melanogaster* (ab), May, 865  
**HORMONES**  
 —See also Adrenals; Androgens; Cholecystokinin; Estrogens  
 —value of an early change in hormonal status through suspension of ovarian function and application of androgens in therapy of advanced mammary carcinoma: experiences with prophylactic x-ray castration in 284 patients (ab), Hanno Poppe and Anton Gregl, March, 519  
**HORSKY, J.** See HENZL, M.  
**HORTENSTINE, CLARENCE B.** See MENDEL, WALTER H.  
**HORTLING, H., PUUPONEN, E., and KOSKI, K.**: Short metacarpal or metatarsal bones: pseudo-pseudohypoparathyroidism (ab), Feb., 332  
**HOSHINO, TAKASHI.** See HEYSEL, ROBERT  
**HOWARD, N., FIELD, E. O., and DYCHE, G. M.**: A comparison of the 15-minute continuous thyroid uptake test with other radioiodine tests (ab), March, 523  
**HOWARD, RUSSELL**: Carcinoma of the thyroid gland in childhood: its relation to radiotherapy (ab), March, 527  
**HRESHCHYSHYN, M.** See SHEEHAN, R.  
**HUDSON, FRANK M.** See CAMPBELL, JAMES B.  
**HUGHES, C. ROBERT.** See ZEIT, PAUL R.

**HUME, MICHAEL, GLENN, W. L., and GRILLO, THERESE:** Behavior in the circulation of the radioactive pulmonary embolus and its application to the study of fibrinolytic enzymes (ab), Feb., 346

**HUMERUS**  
 —fracture separation of lower humeral epiphysis; case (ab), Leonard Marmor and Charles O. Bechtol, Jan., 160  
**HUNT, JAMES CLEON, and PUGH, DAVID G.**: Skeletal lesions in neurofibromatosis, Jan., 1  
**HUNTER, C. G.** See BAKER, D. G.  
**HUNTER, SAMUEL W.** See ABSOLON, KAREL E.  
**HUPPLER, EDWARD G., PRIESTLEY, JAMES T., MORLOCK, CARL G., and GAGE, ROBERT P.**: Diagnosis and results of treatment in gastric polyps (ab), Jan., 154

**HYDATID CYST.** See Lungs, echinococcosis

**HYDROCEPHALUS**  
 —diagnostic approach to infant with an enlarging head (ab), Frederick Murtagh and John A. Kirkpatrick, Jan., 142

**HYDRONEPHROSIS**  
 —backflow patterns in experimental chronic hydronephrosis (ab), Marvin Kazmin et al., May, 856

**HYPOAQUE.** See Iodine and Iodine Compounds

**HYPERCALCEMIA.** See Blood, calcium

**HYPERTENSION.** See Blood Pressure, high

**HYPOPHARYNX.** See Pharynx

**HYPOTHERMIA.** See Cold

**HYPOXIA.** See Oxygen

**HYSTERECTOMY.** See Uterus, excision

## I

**IANNACCONE, A., GABRILOVE, J. L., BRAHMS, S. A., and SOFFER, L. J.**: Osteoporosis in Cushing's syndrome (ab), Jan., 159

The roentgen diagnosis of adrenal tumor in Cushing's syndrome (ab), April, 687

**IBARRA, JESSE D., Jr., THOMPSON, JOHN Q., ALEXANDER, JOHN S., and PETRANY, ZOLTAN**: Radioiodine tracer tests in the evaluation of thyroid function. Results of 6-hour and 24-hour uptake determinations in 357 patients (ab), Feb., 342

**IRHKE, ROYAL E.** See HASEGAWA, JUNJI

**ILBERY, PETER**: Experimental haemopoietic replacement. Possible use in radiotherapy (ab), April, 691

**ILEOPOLEOGRAPHY.** See Bladder, surgery

**ILEUM.** See Intestines

**IMAGE INTENSIFICATION.** See Roentgen Rays, fluoroscopy

**IMARISO, JOHN J.** See KAPLAN, ERVIN

**INDOLES**  
 —testing of indoleamine compounds in prevention of radiation illness (ab), L. F. Semenov, March, 530

## INDUSTRIAL AND OCCUPATIONS

—technical procedures of radiodiagnostic interest. A symposium. III. Brief summary of industrial radiography and automatic processing (ab), A. J. Weston, April, 686

**diseases and poisoning.** See also Pneumoconiosis

—farmer's lung; 2 cases (ab), William P. Baldus and James B. Peter, Feb., 315

## INFANTILISM

—deformity of medial tibial condyle in 19 cases of gonadal dysgenesis (Turner's syndrome) (ab), Jerzy Kosowicz, April, 683

**INFANTS.** See Children; Infants, Newborn

**INFANTS, NEWBORN**

—massive neonatal ascites. Olga M. Baghdassarian, P. Ruben Koehler and Gunter Schultz, April, 586

—radiologic considerations of the perinatal distress syndrome. Edward B. Singleton, Harvey M. Rosenberg and Luis Samper, Feb., 208

## INFANTS, PREMATURE

—new form of respiratory disease in premature infants (ab), Miriam G. Wilson and Victor G. Mikity, Feb., 315

**INFARCTION.** See Colon; Heart; Kidneys; Mesentery

## INFECTIONS

See also Bacteria; Salmonella

—effect of whole-body radiation and infection on arterial replacement (ab), Richard W. Hardy et al., Feb., 350

—studies on susceptibility to infection following ionizing radiation. V. Comparison of intraperitoneal and intravenous challenge at intervals following different doses of x-radiation (ab), C. Phillip Miller et al., April, 700

## INFUSION.

See Uterus, cancer

**INGBAR, SIDNEY H.** See DOWLING, J. THOMAS

**INNES, G. S.** See GALE, NOEL H.

**INTER-AMERICAN CONGRESS OF RADIOLOGY.** April, 649

**INTERCALATING ANGIOGRAPHY.** See Cardiovascular System, roentgenography

**INTERNATIONAL CANCER CONGRESS.** June, 978

**INTERNATIONAL COMMISSION ON RADIOLOGICAL UNITS AND MEASUREMENTS.** report on "Method of Focal Spot Image Formation and Measurement." Jan., 125

**INTERNATIONAL CONGRESS ON ELECTROENCEPHALOGRAPHY AND CLINICAL NEUROPHYSIOLOGY** (Fifth), Feb., 305

**INTERNATIONAL CONVENTION OF X-RAY TECHNICIANS,** Jan., 130

## INTESTINES

See also Colon; Gastrointestinal Tract; Sigmoid

—residual contrast medium in bowel in cholecystography with iopanoic acid and certain related substances (ab), Lars Andrén and Georg Theander, April, 680

**INTESTINES—cont.**

- cancer
  - carcinoid of jejunum (ab), Walter H. Mendel and Clarence B. Hortenstein, Jan., 155
- cysts
  - pneumatosis cystoides intestinalis (report of 16 cases in patients with history of asthma and allergy) (ab), Howard P. Doub and James J. Shea, Jan., 157
  - pneumatosis intestinalis: a new concept, Walter S. Keyting, Robert R. McCarver, Joseph L. Kovari and Alvin L. Daywitt, May, 733
- diverticula
  - diverticulitis of cecum and ascending colon (ab), Virgil C. Daniels and Ernest H. Wood, Jan., 156
  - intramural diverticulitis (ab), R. M. Reynolds et al, Jan., 156
- fistula. See Fistula
- hematoma
  - intramural hematoma of jejunum; case, Gordon J. Culver, Herbert S. Pirson, Elmer Milch, Leonard Berman and F. Jorge Abrantes, May, 785
- mucosa
  - entrance of barium into intestinal glands during barium enema (ab), Leon Sisson, March, 507
  - malabsorption syndromes: a symposium. V. Histopathology of stomach in pernicious anemia and jejunum in steatorrhea (ab), I. Doniach and Margo Shiner, April, 679
- obstruction. See also Gastrointestinal Tract, obstruction
  - clinical and radiologic considerations on acute occlusions of small intestine (ab), R. Boccacio and V. Rizzo, June, 987
  - management of acute intestinal obstruction; critical review of 179 personal cases (ab), Paul T. Savage, March, 507
  - non-strangulating distal ileal obstruction. Part I. The role of hydration. An experimental study correlating pathologic and radiologic findings, Robert D. Sloan, Joseph W. Brock and William M. Fant, March, 407
- physiology
  - clinical assessment of intestinal fat-absorption using radioactive fat (ab), W. F. Walker et al, March, 524
  - clinical behavior of sprue in the United States (ab), Paul A. Green and Eric E. Wollaeger, Feb., 324
  - malabsorption syndromes: a symposium. II. Radiological investigation of malabsorption syndromes (ab), J. W. Laws and R. G. Pitman, April, 678
  - malabsorption syndromes: a symposium. III. Hematologic diagnosis of addisonian pernicious anemia and the intestinal malabsorption syndrome (ab), D. L. Mollin, April, 678
  - rapid screening method for  $I^{131}$  fat-absorption test, Leonard Rosenthal, Feb., 251
- roentgenography. See also Colon, roentgenography; other subheads under Intestines
  - entrance of barium into intestinal glands during barium enema (ab), Leon Sisson, March, 507
  - evaluation of hazards of barium enema examination (ab), Roger Pyle and Eric Samuel, May, 848
  - experiences with oral and rectal contrast media in pediatric radiology (ab), Armand E. Brodeur, April, 675
  - fatal embolization of pulmonary capillaries; report of case associated with routine barium enema (ab), Keith M. Truemner et al, May, 848
  - retrograde enterography: new method for roentgenologic study of small bowel (ab), Edward A. Greenspon and Walter Lentino, March, 506
  - retroperitoneal emphysema as complication of barium enema (ab), F. J. Brunton, May, 849
  - use of parenteral neostigmine in roentgen study of small bowel, Alexander R. Margulis and Paul Mandelstam, Feb., 223
  - value of routine lateral rectal projection in barium-enema study (ab), Henry C. Forrester and A. Bradley Soule, March, 508
- surgery
  - relation of small-bowel resection to nutrition in man (ab), M. H. Kalser et al, Feb., 323
  - retrograde ileoileography (ab), Charles J. Staley, June, 990
  - volvulus
    - diagnostic value of radiography in volvulus of colon (ab), Enrique Schwarz, March, 508
- INTUBATION. See Duodenal Tube
- IODINE AND IODINE COMPOUNDS
  - See also Blood, iodine; Brain, roentgenography; etc.
  - iodine-containing contrast media and interference of Teridax for cholangiograms in evaluation of thyroid function by measurement of serum iodine (ab), Evelyn B. Man, Jan., 165
  - quantitative effect of iodinated opaque media on thyroidal uptake of radioiodine (ab), Ching Tseng Teng and Jean Karamourtjounis, Jan., 170
  - iodized oil. See Brain, roentgenography
  - metabolism. See also Thyronine: Thyroid, aberrant
    - defective iodination of tyrosine a cause of nodular goiter? (ab), John C. Floyd, Jr., et al, April, 692
    - effect of methyl thiouracil and iodide on iodinated constituents of thyroid tissue in Graves' disease (ab), E. Yamazaki et al, April, 692
    - effect of salt feeding on thyroid metabolism of  $I^{131}$  in the dog (ab), Joseph B. Boatman et al, April, 693
    - iodine metabolism in hydatidiform mole and choriocarcinoma (ab), J. Thomas Dowling et al, Jan., 173
  - radioactive. See Goiter; Radioactivity, radioiodine; Thyroid
- toxicity
  - further experimental and early clinical observations concerning the protective action of low molecular weight dextran upon intravenous Hypaque toxicity, Eugene F. Bernstein, Robert L. Evans, John A. Blum, and Robert F. Avant, Feb., 260
  - report of case of injection of massive dose of Urograffin into renal artery (ab), W. M. L. Laubscher and F. P. Raper, June, 990
  - studies of toxicity of Hypaque-90 per cent, following rapid intravenous injection, Eugene F. Bernstein, John D. Palmer, Thomas A. Aaberg and Richard L. Davis, Jan., 88
  - tolerance of kidneys to contrast medium Urograffin (ab), F. G. Smidly and G. K. Arderson, June, 990
  - tonic muscle spasms and blood pressure changes following subarachnoid injection of contrast media: experimental study in dogs with injection of Kontrast U and mixtures of Kontrast U and Xylocaine (ab), B. Funkquist and N. Oehl, April, 687
- IODOPYRACET. See Kidneys, function tests
- IODOTHYRONINE. See Thyronine
- IOPANOIC ACID. See Gallbladder, roentgenography
- IRIDIUM. See Radioactivity, radioiodium
- IRIE, GORO. See POTSAID, MAJIC S.
- IRON. See Ferrous Sulfate; Radioactivity, radioiron
- IRONS, GEORGE V., Jr. See FURST, WILLIAM E.
- IRVING, CHARLES C., and PERKINSON, JESSE D., Jr.: Biochemical effects of internal irradiation (ab), June, 996
- ISAACS, JAMES P., and DAVES, MARVIN L.: Technique and evaluation of operative cholangiography (ab), May, 849
- ISCHEMIA. See Bones; marrow; Brain, blood supply
- ISFORT, A.: Vertebral arteriography of benign tumors (ab), April, 660
- ISODOSE CURVES. See Radioactivity, radiostrontium; Radium; Uterus, cancer
- ISOTOPES. See Radioactivity

**JONES, ARTHUR, and WEDGWOOD, JOHN:** Effects of radiations on the heart (ab), Jan., 175

**JONES, E. D.:** A calcium 137 beam therapy unit. II. Clinical impressions (ab), May, 860

**JONES, HOWARD W., Jr. See DAVIS, HUGH JAMES**

**JONES, J. C. See WHEATLEY, B. M.**

**JONES, K. M. See JELLIFFE, A. M.**

**JONES, MORRIS A. See JOHNSON, PHILIP M.**

**JORDAN, GEORGE L., Jr. See BARTON, HARRY L.**

**JORGENSEN, JOSEPH, KIESEL, ILMAR O., and HAWKINSON, HARLAN W.:** The use of cineradiography in the routine diagnosis of disease of the upper gastrointestinal tract. Experience in 1,000 cases (ab), April, 675

**JOYCE, DAPHNE. See BULL, J. W. D.**

**KAAE, SIGVARD, and BRENE, NIELS:** Wedge filters in roentgen therapy of carcinoma of the larynx and hypopharynx (ab), Jan., 166

**KALOKERINOS, JAMES, and TRACY, G. D.:** Techniques of arteriography (ab), March, 505

—See TRACY, G. D.

**KALSEE, M. H., ROTH, J. L. A., TUMEN, H., and JOHNSON, T. A.:** Relation of small bowel resection to nutrition in man (ab), Feb., 323

**KAMM, MICHAEL L. See WEAVER, JOHN C.**

**KAPLAN, ALLAN A., BRODSKY, LEONARD, and RUMBALL, JOHN M.:** Percutaneous transhepatic cholangiography (ab), March, 511

**KAPLAN, ERVIN, and IMARISIO, JOHN J.:** A continuous monitored dialysis perfusion device for study of two compartmental systems, Jan., 123

**KAPLAN, GUSTAVE, COLLICA, CARL, and RUBENFELD SIDNEY:** Cervical exposure incident to roentgen therapy, June, 877

**KARAMOURTJOUNIS, JEAN. See TENG, CHING TSENG**

**KARR, SAMUEL. See RODMAN, THEODORE**

**KASSAY, DEZO:** Observations on one hundred cases of bronchial foreign body (ab), March, 496

**KATZ, JOSEPH. See COHEN, GEORGE**

**KAY, A. W. See BURNETT, W.**

**KATE, JOSSE, and THOMAS, R. GLYN:** The problem of abnormal radiological lung patterns (ab), May, 841

**KAZMIN, MARVIN, PERSKY, LESTER, and STORAASLI, JOHN P.:** Backflow patterns in experimental chronic hydronephrosis (ab), May, 856

**KEATS, THEODORE E.:** Traumatic transthoracic diaphragmatic herniation of the stomach (ab), March, 505

—See LODWICK, GWILYMI S., and KOENIG, GEORGE F. : Some aspects of cine- and high speed serial angiographic techniques (ab), April, 668

**KECK, CHARLES:** Discography: technique and interpretation (ab), Feb., 332

**KEEGAN, JAMES M. See FLAHERTY, ROBERT A.**

**KEENE, J. P. See DALE, W. M.**

**KEGEL, RICHARD F. C., and FATEMI, ALI:** The ruptured pulmonary hydatid cyst, Jan., 60

**KELLEY, JOHN P. See TROUT, E. DALE**

**KELOID:**

- radiation in management of keloids and hypertrophic scars (ab), H. A. S. Van den Brek and C. C. J. Minty, March, 517
- thyroid cancer after irradiation (for keloid and burn scars) in adult life (ab), A. M. Jelliffe and K. M. Jones, June, 995

**KENDIG, TOM A. See SECREST, P. G.**

**KENSKI, J. See FIELDS, T.**

**KERLEY'S LINES:** See Lungs, roentgenography

**KERMAN, HERBERT D. See FAVIS, EDWARD A.**

**KESSLER, LAIBA A., and STERN, WILHELM Z.:** Posterior migration of a herniated disk, Jan., 104

**KETONES:**

- relation of hepatic ketogenesis to radiation-induced decrease in fasting ketonemia (ab), Joseph A. Ontko, Feb., 350

**KEY, HARVEY. See UYEKI, EDWIN M.**

**KETTING, WALTER S., MCCARVER, ROBERT R., KOVARIK, JOSEPH L., and DAYWITT, ALVIN L.:** Pneumatosus intestinalis: a new concept, May, 733

**KHER, G. A., and MAKHANI, J. S.:** A preliminary study of the lengths of the two main bronchi and angle at the carina (ab), Feb., 318

**KHILANI, MANSHO T.:** Calcifying mucous-cell carcinoma of the stomach. Report of a case (ab), March, 506

—See WOLF, BERNARD S.: Late involvement of the alimentary tract by carcinoma of the kidney (ab), April, 679

**KIDNEYS:**

- See also Hydronephrosis
- tolerance of kidneys to contrast medium Urografin (ab), F. G. Smidt and G. K. Anderson, June, 990
- atrophy
- unilateral renal damage after translumbar aortography (ab), G. Pigeon et al., May, 844
- blood supply. See also Arteries, renal
- differential "nephropacification": a screening procedure for unilateral renal artery occlusion, John C. Rathe, April, 629
- renal angiography records information about renal arterial system (ab), Colvin H. Agnew, Feb., 333
- renal vascular hypertension in children (ab), John P. Smith and Mark L. Saylor, May, 846
- cancer
- late involvement of alimentary tract by carcinoma of kidney (ab), Mansho T. Khilani and Bernard S. Wolf, April, 679

—ureteral metastasis from renal adenocarcinoma presenting a bizarre urogram (ab), James W. Sargent, Jan., 163

—See also Kidneys, tumors

—medullary sponge kidney, A. J. Palubinskas, June, 911

—medullary sponge kidney, roentgen diagnosis of 3 cases, P. G. Secret and Tom A. Kendig, June, 920

**diseases.** See also Pyelonephritis

—studies with chlorothiazide tagged with radioactive carbon (C<sup>14</sup>) in human beings (ab), Herbert R. Brettell et al., May, 858

**diverticula:**

- association of calceal diverticulum and butterfly vertebra (ab), A. Schwartz et al., May, 855

**effects of irradiation:**

- acute tubular and glomerular lesions in rat kidneys after uranium injury (ab), Sergio A. Bencosme et al., April, 699
- cortisone and radiation. III. Histopathology of effect of cortisone on irradiated rat kidney (ab), Charles C. Berdjis, April, 699

**function tests:**

- clinical evaluation of radioactive Diodrast renogram as screening test in hypertension (ab), Ralph A. Straffon and Antonia M. Garcia, March, 524
- concentration of pyelographic contrast media: radiographic method of estimation of renal function (ab), R. H. Owen, June, 988
- excretory urogram as a kidney function test (ab), Chester C. Winter, Jan., 164
- experimental comparison of orthoiodohippuric acid and iodohippurate in renal function evaluation, Joseph E. Whitley, Richard L. Witcofski and I. Meschan, March, 464
- isotopic renogram: method, quantitative analysis, and clinical usefulness (ab), H. W. Roth et al., Feb., 344
- limitation of intravenous pyelogram as a test of renal function (ab), William W. Hoffman and John T. Grayhack, Feb., 333
- method and parameters for analysis of renal function by external scintillation detector technic, Richard L. Witcofski, Joseph E. Whitley, I. Meschan and William E. Painter, April, 621
- technical procedure in kidney examinations with radioactive isotopes (ab), N.-E. Säterborg, April, 695

**hemorrhage:**

- renal fomical hemorrhages: their pathogenesis and treatment (ab), Anton Pytel, April, 684

**hypertrophy:**

- right renal enlargements causing alterations in descending duodenum: a radiographic demonstration, Irwin Bluth and Peter Vitale, May, 777

**infarction:**

- radiographic features of renal infarction: review of 13 cases, E. Robert Heitzman and Lawrence Perchik, Jan., 39

**inflammation.** See Pyelonephritis

**insufficiency:**

- middle-lobe ectasis due to endobronchial sarcoidosis, with hypercalcemia and renal impairment (ab), Gerald J. Goldenberg and Richard H. Greenspan, April, 662

**neerosis:**

- renal papillary necrosis: roentgenographic study of 155 cases (ab), Nils Lindvall, May, 854

**pelvis:**

- backflow patterns in experimental chronic hydronephrosis (ab), Marvin Kazmin et al., May, 856
- pyelorenal uptake in normal and pyelonephritic kidney (ab), Charles H. Nicolai, May, 856

**physiology.** See also Kidneys, function tests

—renal excretion of radiofluoride in dog (ab), Curtis H. Carlson et al., March, 526

**roentgenography:** See also Pyelography; other subheads under Kidneys

—nephrotomography: its role in routine urographic studies (ab), Robert M. Lowman and James T. De Luca, Jan., 164

**sponge.** See Kidneys, cysts

**torsion:**

- rotation of kidney around its longitudinal axis, Bela Gondos, April, 615

**tumors:**

- benign adenomatous polycystic kidney tumor (Perlmann's tumor), Glen D. Dobben, Jan., 100
- contribution to problem of diagnosis, treatment and prognosis of Wilms' tumor (ab), Alexander J. Chiklo, April, 691
- treatment and prognosis of Wilms' tumor in early childhood (ab), P. Kolle, Jan., 168

**wounds and injuries:**

- athlete's kidney (ab), A. H. Kleiman, Feb., 334
- injured kidney (ab), James G. Glenn and B. Marvin Harvard, April, 684
- management of renal injuries (ab), Stanley D. Chovnick and Harry R. Newman, Feb., 333

**KIESEL, ILMAR O. See JORGENSEN, JOSEPH**

**KIMELDORF, D. J., GARCIA, JOHN, and RUBADEAU, D. O.:** Radiation-induced conditioned avoidance behavior in rats, mice, and cats (ab), June, 996

—See GARCIA, JOHN

**KINCAID, OWINGS W.:** Approach to the roentgenologic diagnosis of congenital heart disease (ab), April, 664

**BRANDENBURG, ROBERT O., and BERNATZ, PHILIP E.:** Experiences with angiography as a guide to mediastinal exploration (ab), April, 669

KING, RICHARD L. See STORAASLI, JOHN P.

KIRKLIN, JOHN W. See DuSHANE, JAMES W.

KIRKPATRICK, JOHN A. See MURTAGH, FREDERICK

KIRKPATRICK, W. E. See DOLAN, PATRICK A.

KIRSHNER, J. J. See FRAIMOW, WILLIAM

KIRSNER, JOSEPH B. See RAMOS, ALBERTO RAMIREZ

KISIELESKI, WALTER E. See GREIFF, DONALD

KIVILUOTO, RAIMO: Pleural calcification as a roentgenologic sign of non-occupational endemic anthophyllite-asbestosis (ab), April, 662

KLATTE, EUGENE C. See CAMPBELL, JOHN A.

—See GARRETT, ROBERT A.

KLEIMAN, A. H.: Athlete's kidney (ab), Feb., 334

KLEIN, D. See BROCHER, J. E. W.

KLEIN, S. H. See MARSHAK, R. H.

KLIGERMAN, MORTON M., and HENEL, DORA K.: Some aspects of the microcirculation of a transplantable experimental tumor, May, 810

KNAPP, J. R. See SHARP, C. M.

KNEE

roentgenography

—meniscography by van der Berg's double contrast technic (ab), Ulf Zakrisson, April, 683

KNIGHT, CHARLES D., TRICHEL, B. E., and MATHEWS, W. R.: Nonfunctioning carcinoma of the adrenal cortex (ab), Feb., 335

KOEHLER, P., RUBEN, FABRIKANT, JACOB I., and DANA, EDWARD R.: Gastric retention during oral cholecystography due to underlying lesions of the stomach and duodenum (ab), Feb., 323

—See BAGHDASSARIAN, OLGA M.

KOENIG, GEORGE F. See KEATS, THEODORE E.

KOIVISTO, E., PYYKÖNEN, L., and WEGELIUS, C.: A method for roentgenologic measurements from spot fluorograms. Its application to skull capacity determination (ab), June, 983

KOLÁŘ, JAROMÍR, and BEK, VÁCLAV: The influence of x-ray contact therapy of hemangiomas on the growing skeleton (ab), April, 695

—and VRABEC, R.: Roentgenological bone findings after high-voltage injury (ab), Feb., 347

KOLLE, P.: Treatment and prognosis of Wilms' tumour in early childhood (ab), Jan., 168

KOMRAD, EUGENE L. See SEITCHIK, MURRAY W.

KONTRAST U. See Iodine and Iodine Compounds

KOPF, ALFRED W. See BRAUER, EARLE W.

KOPPLITZ, R. MARLENE. See PRIEST, ROBERT E.

KORELITZ, B. I. See MARSHAK, R. H.

KOSKI, K. See HORTLING, H.

KOSOWICZ, JERZY: The deformity of the medial tibial condyle in nineteen cases of gonadal dysgenesis (ab), April, 683

KOVÁČ, AKOS: Asymmetrical roentgenography of the vocal chords (ab), April, 680

KOVARIK, JOSEPH S. See KEYTING, WALTERS.

KRAMER, SIMON. See WALLACE, SIDNEY

KRATOCHWIL, ALFRED, LEHRNER, HANS, and SCHÜLLER, EDMUND: Artificial menopause with the aid of ionizing rays (ab), March, 522

KRIEGER, H. See ABBOTT, WILLIAM E.

—See STORAASLI, JOHN P.

KRIGE, H. See CYWES, S.

—See SEALY, ROSSALL

KRUYFF, EVERET: Some remarks on encephalography (ab), June, 983

KRYPTON. See Radioactivity, radio-krypton

KUENSTLER, PATRICIA. See GUSS, LEWIS W.

KUHN, ROBERT A.: The normal brachial cerebral angiogram (ab), June, 983

KURRLE, G. R.: The combined radio-surgical treatment of carcinoma of the cervix uteri (ab), April, 690

KURZWEG, FRANK T. See FOMON, JOHN J.

KUTTIG, H. See BAUM, F. K.

L

LACHMAN, ERNEST. See CHRISTENSEN, JOHN B.

LADNER, HANS-ADOLF. See LANGENDORFF, HANNS

LAMB, JOHN H., and MINOR, DWANE B.: Carcinoma of the oral cavity. Parts I and II (ab), March, 518

LAMBERT, PETER B. See BELLMAN, SVEN

—See WILLIAMS, JOHN A.

MERTON, L. F., PONTIFEX, A. H., BLACKETT, N. M., and ADAMS, KAY: Effects of protracted irradiation on the blood-forming organs of the rat. Part I: Continuous exposure (ab), March, 528

LAMINAGRAPHY. See Body-Section Roentgenography

LAMON, C. B., and WOLLIN, D. G.: An assessment of the methods for determination of the position of the pineal gland in lateral skull roentgenograms (ab), May, 839

LANG, ERICH K., and SABISTON, DAVID C., Jr.: Coronary arteriography in the selection of patients for surgery, Jan., 32

LANGDON, EDWARD A. See CHEITLIN, MELVIN D.

LANGENDORFF, HANNS, MELCHING, HANS-JOACHIM, and LADNER, HANS-ADOLF: Biologic protection against repeated lethal total-body exposure doses (ab), March, 529

LANGNER, E. See HAWLICZEK, F.

LANSCHER, W. EDWARD, and FORD, LEE T.: Correlation of the myelogram with clinical and operative findings in lumbar disc lesions (ab), Jan., 159

LANTHANUM. See Radioactivity, radio-lanthanum

LARSEN, WILLIAM E. See WINEINGER, JOHN H.

LARYNGOCELE: See Larynx

LARYNX

cancer

—wedge filters in roentgen therapy of carcinoma of larynx and hypopharynx (ab), Sigvard Kaae and Niels Brene, Jan., 166

roentgenography

—clinical and radiologic considerations on symptomatic laryngocoele (ab), G. Agati and L. Adagio, June, 986

LASSER, ELLIOTT C. See FEIST, JOHN H.

LATOURE, J. P. A. See ARRONET, G. H.

—See BLÖNDAL, H.

LATA, HARRISON. See BENCOSME, SERGIO A.

LAUBSCHER, W. M. L., and RAPER, F. P.: A report of a case of the injection of a massive dose of Urographin into the renal artery (ab), June, 990

LAUCHENAUER, CLARA. See LUDIN, H.

LAUER, RONALD M., DuSHANE, JAMES W., and EDWARDS, JESSE E.: Obstruction of left ventricular outlet in association with ventricular septal defect (ab), June, 987

LAUGHLIN, J. S. See BARR, NATHANIEL F.

LAWLS, J. W., and PITMAN, R. G.: Malabsorption syndromes: a symposium. II. Radiological investigation of malabsorption syndromes (ab), April, 678

Malabsorption syndromes: a symposium. IV. The radiological features of pernicious anaemia (ab), April, 679

LEADBETTER, GUY W., Jr., DUXBURY, JAMES H., and DREYFUSS, JACK R.: Absence of vesicovaginal reflux in normal adult males (ab), May, 854

LE BLANC, GILBERT A. See LUND, RONALD R.

LEDLIE, E. M.: The incidence of leukaemia in patients with polycythaemia vera treated by  $\text{P}^{32}$  (ab), Feb., 344

LEFCOE, NEVILLE M., and GOODALL-COPESTAKE, GERALD: The relationship of the hyperinflated lung to obstructive pulmonary disease (ab), Jan., 144

LEFEBVRE, R. See PIGEON, G.

LEGRE, J., and SERRATRICE, G.: Radiologic aspects of primary tumors of the spine and their treatment; 40 cases (ab), March, 520

LEGS

See also Extremities

—familial epiphysial dysplasia of lower limbs (ab), H. Weinberg et al., March, 515

—reaction of limb regenerates of adult axolotl (Sirendon melanum) to x-irradiation (ab), V. V. Brunt, June, 998

LEHMAN, J., STAUFFER, and DEBBAS, JOSEPH N.: An evaluation of cardiovascular contrast media, April, 684

LEHRNER, H. See KRATOCHWIL, ALFRED

LEIGH, TED F.: Acute gastric dilatation (ab), Jan., 152

LEIOMYOSARCOMA. See Sarcoma, myosarcoma

LEMON, WILLIS E. See REAVIS, CHARLES W.

LENTINO, WALTER, COLICCA, CARL, and RUBENFELD, SIDNEY: Radioactive iron techniques in clinical practice (ab), May, 858

—See GREENSPAN, EDWARD A.

LESSMANN, F. P. See SHEEHAN, R.

LESTER, RICHARD G., ANDERSON, RAY C., AMPLATZ, KURT, and ADAMS, PAUL: Roentgenologic diagnosis of congenitally corrected transposition of the great vessels (ab), April, 666

—See AMPLATZ, KURT

LETTERS TO EDITOR

Comment on article by Mintz and Matthes on bone-free detection of intracocular foreign bodies, J. Worst, April, 650

Statistics and the physician, comment on editorial by Christian V. Cimmino, R. R. Newell, May, 831

LEUCINE

—in vitro leucine incorporation into protein of normal and x-irradiated rabbit bone marrow cells (ab), Edwin M. Uyeki et al., Feb., 349

LEUKEMIA

—acute leukemia after radioactive iodine ( $I^{131}$ ) therapy for hyperthyroidism (ab), Thomas W. Burns et al., May, 862

—chronic myeloid leukemia; 116 cases (ab), Sandhya Ghose and J. B. Chatterjee, March, 522

—geographical variation in leukemia mortality in relation to background radiation and other factors (ab), W. M. Court Brown et al., April, 697

—incidence of leukemia in patients with polycythemia vera treated by  $\text{P}^{32}$  (ab), E. M. Ledlie, Feb., 344

—kinetics of intravenously injected radioactive vitamin B<sub>12</sub>: studies on normal subjects and patients with chronic myelocytic leukemia and pernicious anemia (ab), Eugene A. Brody et al., June, 995

—late effects of x-radiation: influence of dose fractionation on life span, leukemia, and nephrosclerosis incidence in mice (ab), L. J. Cole et al., May, 862

—leukemia after  $I^{131}$  therapy for thyroid cancer (ab), A. M. Jelliffe and K. M. Jones, Feb., 343

—leukemia following x-ray therapy for ankylosing spondylitis (ab), Donald C. Graham, April, 696

—leukemia in Hiroshima atomic bomb survivors (ab), Robert Heyssel et al., Feb., 348

—observations on 100 cases of leukemia in childhood (ab), Reginald Lightwood et al., Feb., 329

—roentgen findings in thorax in chronic leukoses (ab), H. Hartweg, March, 500

LEUKOSIS. See Leukemia

LEVEY, S. See ABBOTT, WILLIAM E.

LEVI, I. See BLONDAL, H.

LEVIN, BERTRAM, and WHITE, HARVEY: Total anomalous pulmonary venous drainage into the portal system, June, 894

LEVIN, EMANUEL J. See SOLOMONS, EDWARD

LEVIN, WILLIAM C., SCHNEIDER, MARTIN, and GERSTNER, HERBERT B.: Initial clinical reaction to therapeutic whole-body roentgen radiation. Some Civil Defense considerations (ab), Jan., 177

LEVY, D. W. See DODD, N. F.

LEVY, J. R., RHODES, D. H., Jr., and PAVSEK, E. J.: Roentgenologic manifestations of fracture of the orbital floor (blow-out fracture) (ab), Feb., 313

LEWIS, GEORGE C., Jr., RAVENTOS, ANTOLIN, and HALE, JOHN: Space dose relationships for points A and B in the radium therapy of cancer of the uterine cervix (ab), Jan., 167

LEWIS, S. M., SZUR, L., and DACIE, J. V.: The pattern of erythrocyte destruction in haemolytic anaemia, as studied with radioactive chromium (ab), Feb., 345

LEWIS, N. A.: Venous changes in central brain tumours (ab), March, 493

LEBBE, EDWIN J. See CHAN, PAUL Y. M.

LEGAMENTS

- broad. See Broad Ligament
- fibular collateral. See Ankle

LIGHTWOOD, REGINALD, BARRIE, HERBERT, and BUTLER, NEVILLE: Observations on 100 cases of leukaemia in childhood (ab), Feb., 329

LILLEHEI, C. WALTON. See AMPLATZ, KURT

LILLEHEI, R. K. See SHEEHAN, R.

LINDBERG, R. G. See HALEY, THOMAS J.

LINDBLOM, K.: Roentgen television in surgery with special reference to stereo-television (ab), April, 687

LINDBOM, A. See HELANDER, C. G.

LINDSAY, S. See POTTER, G. D.

LINDVALL, NILS: Renal papillary necrosis. A roentgenographic study of 155 cases (ab), May, 854

LINEAR ACCELERATOR

- carcinoma of bladder: its treatment by supervoltage x-ray therapy (ab), Robert Morrison, Feb., 341
- relative biological efficiency of 20 Mev and 4 Mev radiations. Report from the Medical Research Council Group, Christie Hospital, Manchester 20 (England). Parts I-VII (ab), Ralston Paterson et al, March, 530
- some clinical aspects of megavoltage: a wedge filter approach with 4 Mev radiation to treatment of carcinoma of alveolus and antrum (ab), J. G. Stewart, Feb., 340
- some clinical aspects of megavoltage: bladder carcinoma (ab), R. C. S. Pointon, Feb., 340
- some clinical aspects of megavoltage: seminoma of testis (ab), Robert Gibb, Feb., 339
- some clinical aspects of megavoltage: treatment of carcinoma of middle ear by 4 Mev linear accelerator (ab), K. S. Holmes, Feb., 340

LINITIS PLASTICA. See Stomach, cancer

LIPIDS. See Lipoids; Pneumonia, lipid

LIPIDS

- absorption of  $^{141}$ -labeled lipids after intraduodenal administration: effect of lipid prefeeding (ab), Benno Janssen, Jr., et al, Jan., 174

LIPOSARCOMA. See Sarcoma, liposarcoma

LIPPINCOTT, STUART W., YAMAMOTO, Y., LUCAS, and FARR, LEE E.: Radiation effects of neutron-capture therapy on a malignant vascular neoplasm of the cerebellum. Histopathological observations (ab), March, 517

See BOND, V. P.

See CRONKITE, E. P.

See SHELLABARGER, C. J.

LIPS

- cancer
- roentgen therapy of skin and lip carcinoma: factors influencing success and failure (ab), Carl F. von Essen, Jan., 165

LIPSCOMB, PAUL R. See HARRIS, LLOYD E.

LISCHI, G.: The rare "os supracaroticidum" (ab), April, 682

LITTLE, J. W., Jr. See SMULLEN, W. C.

LITTMANN, DAVID. See BELLMAN, SVEN

See WILLIAMS, JOHN A.

LIVER

- relation of hepatic ketogenesis to radiation-induced decrease in fasting ketonemia (ab), Joseph A. Ontko, Feb., 350
- blood supply
- percutaneous lienoportal venography in demonstration of liver masses (ab), Sture Stattin, Feb., 326
- percutaneous splenoportal venography, with additional comments on transhepatic venography (ab), Sherwin S. Zein et al, April, 673
- polycystic disease of liver, with unusual cholecystographic manifestations; case (ab), Earl E. Gambill and John R. Hodgson, April, 679
- diseases
- anemia of hepatic disease studied with radiochromium (ab), Madison J. Cawein, III, et al, Feb., 345
- studies with chlorothiazide tagged with radioactive carbon ( $C^{14}$ ) in human beings (ab), Herbert R. Brettell et al, May, 858
- function tests
- hepatography and study of liver function by means of  $I^{131}$ -tagged rose bengal (ab), D. Ziliotto, March, 524

LIVERSAGE, W. E.: A method of estimating dose with multiple x-ray beams, the central rays of which are not coplanar, and its application to moving beam therapy (ab), Jan., 170

LOCHTE, HARRY L., Jr. See MANNICK, JOHN A.

LOCKHART, JORGE, GORERO ARMAS, A., and POLLERO, HECTOR J.: Cavigraphy in cases of testis tumors (ab), Feb., 335

LODWICK, GWILYM S. See KEATS, THEODORE E.

LODWIG, G. S. See SMITH, W. G.

LOEFFLER, R. KENNETH: Place of radiation therapy in the treatment of cancer (ab), March, 517

LOEWEN, DAVID F., PROCNOW, JOHN J., and LOOSLI, CLAYTON G.: Chronic active pulmonary histoplasmosis with cavitation. A clinical and laboratory study of thirteen cases (ab), Feb., 316

See PROCNOW, JOHN J.

LOGIE, L. C., HARRIS, M. D., TATSCH, R. E., and VAN HOOPER, E. P.: An analysis of the  $LD_{50/30}$  as related to radiation intensity (ab), May, 863

See ALLEN, RALPH G.

LOKER, MERLE K., BEISANG, ARTHUR A., JOHNSON, EUGENE A., and MOSSER, DONN G.: The relative biological effectiveness of cobalt-60 gamma rays and 220-kvp x-rays on the viability of chicken eggs (ab), May, 865

See GREENSPAN, RICHARD H.

LOMBARDI, G., and PASSERINI, A.: Spinal cord tumors, March, 314

LONG, ROBERT T. L., BRAUNWALD, EUGENE, and MORROW, ANDREW G.: Intracardiac injection of radioactive krypton. Clinical applications of new methods for characterization of circulatory shunts (ab), May, 858

LONG, SISTER VICTORINE. See ABSOLON, KAREL E.

LONG, THOMAS S. See REAVIS, CHARLES W.

LOOSLI, CLAYTON G. See LOEWEN, DAVID F.

LORENZI, G. L. See MUCCI, L.

LOUGHEED, M. N., and MAGUIRE, G. H.: Irradiation pneumonitis in the treatment of carcinoma of the breast (ab), Feb., 346

See BEIQUE, R. A.

LOWMAN, ROBERT M., and DE LUCA, JAMES T.: Nephrotomography: its role in routine urographic studies (ab), Jan., 164

See NAGLER, RICHARD

LOWNEY, JOHN F. See BURNS, THOMAS W.

LUAN, LAWRENCE L., D'SILVA, JOSEPH LLOYD, GASUL, BENJAMIN M., and DILLON, ROBERT F.: Stenosis of the right main pulmonary artery. Clinical, angiographic, and catheterization findings in ten patients (ab), May, 844

See LYNNFIELD, JOSHUA

LUCAS, ARTHUR C. See TROUT, E. DALE

LUDIN, H., and LAUCHENAUER, CLARA: A comparative assay of Biligrain and perorally effective cholangio-cholecystography contrast media (Biloptin and related substances) (ab), Feb., 327

LUKAS, DANIEL S. See AYRES, STEPHEN M.

LUND, RONALD R., GARCIA, NICHOLAS A., III, LE BLANC, GILBERT A., GARTENLAUB, C., and RICHARDSON, J. FRANCIS: Inferior vena cavaography in preoperative localization of pheochromocytoma (ab), March, 517

LUNGS

- See also Bronchi; Bronchiectasis; Pleura; Respiratory Tract; etc.
- acceptance of rat and mouse lung grafts by radiation chimeras (ab), George W. Santos et al, April, 702
- abnormalities
- congenital anomalies of lung (ab), James A. Wier, Jan., 143
- amebiasis. See Amebiasis
- blood supply. See also Arteries, pulmonary; Embolism, pulmonary
- cortisone and irradiation. II. Pulmonary necrosis and blood vessel impairment in irradiated cortisone-treated rat lung (ab), Charles C. Berdiss, April, 698
- radiological appearances of pulmonary hypertension (ab), J. K. McMyn, April, 668
- selection for surgery of patients with ventricular septal defect and pulmonary hypertension (ab), James W. DuShane and John W. Kirklin, Jan., 148
- cancer
- cavitory carcinoma of lung: roentgenologic features in 19 cases (ab), C. Allen Good and Colin B. Holman, Jan., 146
- comparison of three different methods of external irradiation, and their results, in the treatment of inoperable carcinoma of lung, Ruth J. Guttmann, Jan., 83
- evaluation of roentgen therapy in management of non-resectable carcinoma of lung (ab), Harry L. Barton et al, Jan., 166
- five-year follow-up of roentgenographically detected lung cancer suspects (ab), Lewis W. Guiss, April, 661
- irradiation and surgery in treatment of bronchogenic carcinoma (ab), Fernando G. Bloedorn and R. Adams Cowley, June, 992
- osteoblastic bone metastases in gastrointestinal and bronchial carcinoids (ab), Frances B. Toomey and Benjamin Felson, Feb., 329
- palliative irradiation of bronchial carcinoma (ab), Peter Hackenthal, Jan., 166
- pulmonary metastasis from trophoblastic tumors, Lloyd K. Mark and Morris Moel, April, 601

**LUNGS, cancer**—*cont.*

- radiation reaction in lung; report of fatal case in patient with carcinoma of lung, with studies of pulmonary function before and during prednisone therapy (ab), Theodore Rodman et al, Feb., 347
- retrospective view of survey photofluorograms of persons with lung cancer (ab), Lewis W. Guiss and Patricia Kuenster, April, 661
- roentgenologic manifestations of trophoblastic tumors (ab), Theodore F. Hilbush and Emil Schulz, Jan., 162
- cavitation.** See Aspergillosis; Histoplasmosis
- collapse**
- atelectatic complex of left lung (ab), Björn Nordenström and Jaan Novek, Jan., 145
- middle-lobe atelectasis due to endobronchial sarcoidosis, with hypercalcemia and renal impairment (ab), Gerald J. Goldenberg and Richard H. Greenspan, April, 662
- diseases.** See also Pneumonia; Tuberculosis, Pulmonary; etc.
- actinomycosis.* See Actinomycosis
- aspergillosis.* See Aspergillosis
- histoplasmosis.* See Histoplasmosis
- misleading thoracic roentgenograms; cardiovascular abnormalities that may simulate diseases of lungs, bony thorax, or mediastinum (ab), Corrin H. Hodgson et al, April, 663
- multiple myeloma manifested as a problem in diagnosis of pulmonary disease (ab), Edward A. Favis et al, Feb., 317
- primary pulmonary histiocytosis X (ab) Pierre J. Nadeau et al, Jan., 146
- proteinosis.* See Proteinosis
- pulmonary alveolar proteinosis.* See Proteinosis
- relationship of hyperinflated lung to obstructive pulmonary disease (ab), Neville M. Lefcoe and Gerald Goodall-Copstake, Jan., 144
- echinococcosis*
- ruptured pulmonary hydatid cyst, Richard F. C. Kegel and Ali Fatemi, Jan., 60
- x-ray diagnosis of hydatid cyst of lung: its rupture into bronchus and spontaneous healing (ab), R. Venkateswara Rao, March, 499
- effects of irradiation.** See also Lungs, cancer; Pneumonitis
- cortisone and irradiation. II. Pulmonary necrosis and blood vessel impairment in irradiated cortisone-treated rat lung (ab), Charles C. Berdjis, April, 698
- radiation reaction in lung; report of fatal case in patient with carcinoma of lung, with studies of pulmonary function before and during prednisone therapy (ab), Theodore Rodman et al, Feb., 347
- single dosage x-ray radiation to lung and posterior mediastinum through open chest. II. Results in animals receiving 5,000 r (ab), John J. Fomon et al, Feb., 348
- emphysema.** See Emphysema, pulmonary
- fibrosis
- chronic diffuse interstitial fibrosis of lungs (ab), J. G. Scadding, Jan., 145
- mycosis.** See Actinomycosis; Aspergillosis; Histoplasmosis
- necrosis.** See Lungs, effects of irradiation
- pathology**
- effect of intravenous paradehydite as recorded by chest x-ray film, case (ab), Jerome A. Gold et al, April, 663
- periarteritis nodosa with labile and recurrent pleuropulmonary manifestations without asthma or serum hyper-eosinophilia (ab), J. Turiaf et al, Feb., 316
- pleural calcification as roentgenologic sign of nonoccupational endemic anthophyllite-asbestosis (ab), Raimo Kiviuoto, April, 662
- roentgen changes in thorax in periarteritis nodosa (ab), K. H. Vogel and E. Flink, March, 499
- physiology**
- pulmonary function impairment in pneumoconioses (ab), Hurley L. Motley, Feb., 315
- radiation reaction in lung; report of fatal case in patient with carcinoma of lung, with studies of pulmonary function before and during prednisone therapy (ab), Theodore Rodman et al, Feb., 347
- roentgenography.** See also other subheads under Lungs
- “B” lines of Kerley and left atrial size in mitral valve disease: their correlation with the mean left atrial pressure as measured by left atrial puncture, R. E. McIhem, J. D. Dunbar and R. W. Booth, Jan., 65
- hypertransradiancy of one lung field and its experimental production by unilateral pulmonary embolism of pulmonary arteries in cats (ab), R. F. Fouché and J. L. D'Silva, March, 501
- problem of abnormal radiological lung patterns (ab), Josse Kaye and R. Glynn Thomas, May, 841
- roentgen findings after pulmonary surgical procedures (ab), G. Viehweger, May, 841
- tuberculosis.** See Tuberculosis, Pulmonary
- tumors**
- pulmonary manifestations of lymphogranulomatosis (ab), Alberto Banfi, June, 987
- vital capacity.** See Vital Capacity

**LUST, FRANZ J. and HEIMLICH, HENRY J.:** Roentgenographic findings in an early case of *limitis plastica* (ab), March, 506

**LYMPH NODES**

- calcification**
- calcified hilar node: its significance and management; a review (ab), John Storer and Ralph C. Smith, April, 663

**cancer**

- effect of radiation on metastatic pelvic lymph nodes judged by pelvic venograms, Sumner Holtz, William E. Powers and Alfred I. Sherman, Feb., 287
- localized obstructive emphysema** produced by extrabronchial lesion (giant follicular lymphoblastoma) (ab), Carl Oshrain and Coleman H. Rosenberg, Jan., 144

**LYMPHANGIOGRAPHY.** See Lymphatic System

**LYMPHANGIOMA.** See Tumors, angioma

**LYMPHATIC SYSTEM**

- lymphangiograms: their diagnostic and therapeutic potential, Sidney Wallace, Laird Jackson, Burton Schaefer, John Goldblatt, Roy R. Greening, Arthur Weiss and Simon Kramer, Feb., 179
- use of lymphography as a diagnostic method, R. Sheehan, M. Hreshchysyn, R. K. Lin and F. P. Lessmann, Jan., 47

**LYMPHOGRANULOMATOSIS.** See Hodgkin's Disease

**LYMPHOGRAPHY.** See Lymphatic System

**LYMPHOSARCOMA.** See Sarcoma, lymphosarcoma

**LYNFIELD, JOSHUA, GASUL, BENJAMIN M., LUAN, LAWRENCE L., and DILLON, ROBERT F.:** Right and left heart catheterization and angiographic findings in idiopathic cardiac hypertrophy with endocardial fibroelastosis (ab), Jan., 147

**LYNN, W. GARDNER, and DENT, JAMES NORMAN:** The action of various goitrogens in inhibiting localization of radioiodine in the thyroid and thymus glands of larval tree toads (ab), April, 693

**LYUBIMOVA-GERASIMOVA, R. M.:** Changes in the cerebral circulation of an animal after whole-body ionizing irradiation (ab), Feb., 349

M

**MCAFEE, JOHN G.** See DONNER, MARTIN W.

**MALLISTER, J.** See OVADIA, J.

**MALLISTER, JOHN D.** See PERRYMAN, C. RICHARD

**MACARINI, N., SCURSATONE, M., and ZINICOLA, N.:** Pelvic arteriography in gynecologic conditions (ab), June, 988

**MACARVER, ROBERT R.** See KEYTING, WALTER S.

**MACCOMB, WILLIAM S.** See FLETCHER, GILBERT H.

**MCNAHEY, WILLIAM M.** See OWEN, CHARLES A., Jr.

**MCCORT, JAMES J.:** Infarction of descending colon due to vascular occlusion. Report of 3 cases (ab), Jan., 155

**MCCREA, ALICE L.** See CAMPBELL, JOHN A.

**MCCULLOUGH, JAMES Y.:** The effect of roentgen therapy upon gastric acidity. Clinical and experimental studies (ab), Jan., 176

**MACDONALD, IAN.** See GUSS, LEWIS W.

**MACFARLANE, P. S.** See BURNETT, W.

**McGINNIS, G. O.:** Adenocarcinoma of the stomach with calcification. A case report (ab), May, 847

**McGIRR, E. M.** See MURRAY, I. P. C.

**McGOVERN, JOHN H.** See PAQUIN, ALBERT J., Jr.

**McGRANAHAN, G. M., Jr.** See BARTON, HARRY L.

**McGREGOR, J. F., JAMES, A. P., and NEWCOMBE, H. B.:** Mutation as a cause of death in offspring of irradiated rats (ab), April, 700

**MCHUGH, M. J.** See COURT BROWN, W. M.

**MCINNES, JAMES:** Technical procedures of radiodiagnostic interest. A symposium. IV. Methods of multiple radiography (ab), April, 686

**MCINTOSH, HENRY D.** See PERKINS, HENRY T., Jr.

**MCINTYRE, R. S.:** Traumatic aneurysm of the thoracic aorta (ab), April, 667

**MACK, PAULINE BEERY.** See VOSE, GEORGE P.

**MEKELLAR, N. J.** See DUTHIE, H. L.

**MCKENZIE, BERNARD F.** See OWEN, CHARLES A., Jr.

**MCKIBBEN, W.** See HALEY, THOMAS J.

**MCKIE, J.** See WALKER, W. F.

**MC LAUGHLIN, MARY M.** See BRENT, ROBERT L.

**MC MYN, J. K.:** Radiological appearances of pulmonary hypertension (ab), April, 668

**MCRAE, DONALD L.:** The significance of abnormalities of the cervical spine (ab), June, 985

**McTAGGART, WATSON G., WEST, WALTON D., CLAYPOOL, HARRY A., and COLLINS, VINCENT P.:** Tissue isodose curves for beta surface applicators, Feb., 278

**McWHIRTER, ROBERT:** Measurement of the value of treatment in malignant disease (ab), June, 991

**MADDALONE, L.** See ROSWIT, B.

**MADDEN, SIDNEY C.** See BENCOSE, SERGIO A.

**MAGUIRE, G. H.** See LOUGHED, M. N.

**MAHONEY, M. P.** See SMITH, W. G.

**MAISIN, H.** See DUNJIC, A.

**MAKHANI, J. S.** See KHER, G. A.

**MAKIN, M.** See WEINBERG, H.

**MALABSORPTION SYNDROME**

- See also Celiac Disease; Sprue; Steatorrhea
- malabsorption syndromes: a symposium. I. Classification of malabsorption syndrome (ab), C. C. Booth, April, 678
- malabsorption syndromes: a symposium. II. Radiological investigation of malabsorption syndromes (ab), J. W. Laws and R. G. Pitman, April, 678
- malabsorption syndromes: a symposium. III. Hematological diagnosis of addisonian pernicious anemia and the intestinal malabsorption syndrome (ab), D. L. Mollin, April, 678

**MALABSORPTION SYNDROME**—*cont.*  
 —malabsorption syndromes: a symposium. IV. Radiological features of pernicious anemia (ab), J. W. Laws and R. B. Pitman, April, 679  
 —malabsorption syndromes: a symposium. V. Histopathology of stomach in pernicious anemia and jejunum in steatorrhea (ab), I. Doniach and Margot Shiner, April, 689

**MALDAUGUE, P.** See DUNJIC, A.

**MALFORMATIONS.** See Abnormalities and Deformities; Dwarism; Monsters; etc.

**MALKSY, S. J.** See AMATO, C. G.

**MAN, EVELYN B.** A note about iodine-containing contrast media and the interference of Teridox for cholangiograms in evaluation of thyroid function by measurement of serum iodine (ab), Jan., 165

**MANDELSTAM, PAUL.** See MARGULIS, ALEXANDER R.

**MANDIBLE.** See Jaws

**MANGANESE**  
 —placental transfer of phosphorus in sows maintained on high and low levels of dietary manganese (ab), H. W. Nordin et al, March, 526

**MANNICK, JOHN A.** LOCHTE, HARRY L., Jr., ASHLEY, CHARLES A., THOMAS, E., DONNALL, and FERREBEE, JOSEPH W.: Autografts of bone marrow in dogs after lethal total-body radiation (ab), Jan., 178

**MANOMETRY**  
 —cholangiomanometric interpretation of lesions in main biliary duct: 800 peroperative examinations (ab), A. A. Ariantoff and E. H. Henrard, April, 680

**MARCIAL-ROJAS, RAUL A.** Primary hemangiopericytoma of bone. Review of the literature and report of the first case with metastases (ab), Feb., 328

**MARGULIS, ALEXANDER R.**, and **MANDELSTAM, PAUL**: The use of parenteral neostigmine in the roentgen study of the small bowel, Feb., 223

**MARINELLO, ZOILLO**: Metastatic cancer of the neck (ab), Jan., 165

**MARK, LLOYD K.** Fractures of the triquetrum (ab), Feb., 332

**— and MOEL, MORRIS**: Pulmonary metastasis from trophoblastic tumors, April, 601

**MARLAND, P.** See TURIAF, J.

**MARMOR, LEONARD**, and **BECHTOL, CHARLES O.**: Fracture separation of the lower humeral epiphysis. Report of a case (ab), Jan., 160

**MARSH, ALBERT P.** Primary diabetic pneumonitis diagnosed radiographically (ab), Jan., 163

**MARSHAK, R. H.**, KORELITZ, B. I., KLEIN, S. H., WOLF, B. S., and JANOWITZ, H. D.: Toxic dilation of the colon in the course of ulcerative colitis (ab), Jan., 155

**MARSHALL, J.** See BULL, J. W. D.

**MARSHALL, VICTOR F.** See PAQUIN, ALBERT J., Jr.

**MARTIN, EDGAR J.** See HYPERMIA and ischemia of the bone marrow as protection against injury by whole-body x-irradiation in rats (ab), June, 997

**MARTIN, SAMUEL**. See SCHWARZ, ENRIQUE

**MASON, R. M.** See SWEETNAM, D. R.

**MASSACHUSETTS INSTITUTE OF TECHNOLOGY REACTOR**  
 —calibration studies at medical therapy facility of Massachusetts Institute of Technology (MIT) reactor, Gordon L. Brownell, Charles Porter and Theos J. Thompson, Jan., 124

**MASSEY, JOHN B.** See GREENE, DAVID

**MASSOUD, G. E.**, and **AWWAD, H. K.**: Nasopharyngeal fibroma. Its malignant potentialities and radiation therapy (ab), June, 992

**MASTECTOMY**. See Breast, cancer

**MATHEWS, W. R.** See KNIGHT, CHARLES D.

**MATSUBARA, TOSHIO**, and **NOMURA, TAKAYOSHI**: Emulsion iodized oil ventriculography (ab), May, 838

A sign of cerebral ventricular dilatation observed in carotid angiograms (ab), June, 985

**MATTSSON, OVE**. See DOHLMAN, GÖSTA

**MAXILLARY SINUS**  
 —cancer  
 —epitheliomas of maxillary sinus treated with external roentgen therapy alone; results at five years (ab), F. Balescu et al, April, 689  
 —some clinical aspects of megavoltage: a wedge filter approach with 4 Mev radiation to treatment of carcinoma of alveolus and antrum (ab), J. G. Stewart, Feb., 340

**MAYER, J. W.** See BAILY, NORMAN A.

**MAYER, C. W.** See GLAD, B. W.

**MEDIASTINUM**  
 —arterial malformation in superior mediastinum (ab), S. Brunner et al, Jan., 148  
 —single dosage x-ray radiation to lung and posterior mediastinum through open chest. II. Results in animals receiving a dose of 5,000 r (ab), John J. Fomon et al, April, 648

**diseases**  
 —misleading thoracic roentgenograms: cardiovascular abnormalities that may simulate diseases of lungs, bony thorax, or mediastinum (ab), Corrin H. Hodgson et al, April, 663

**surgery**  
 —experiences with angiography as guide to mediastinal exploration (ab), Owings W. Kincaid et al, April, 669

**tumors**  
 —*intrathoracic goiter*. See Goiter, intrathoracic

**Malignant mediastinal teratoma with bone metastases; case**. Arch W. Templeton, Feb., 245

**MEDICINE**  
 —medical electronics and electrical techniques in medicine and biology; combined conferences, June, 978

**—role of diagnostic roentgenology in medicine (ab)**, Max Ritvo, April, 659

**MEDLEN, AMMON B.** See VOSE, GEORGE P.

**MEGACOLON**. See Colon, dilatation

**MEGACYSTIS**. See Bladder, regurgitation from

**MEGAVOLTAGE THERAPY**. See Betatron; Bladder, cancer; Ear, cancer; Jaws, cancer; Linear Accelerator; Maxillary Sinus; Testes, tumors

**MEISSNER, WILLIAM A.** See SMEDAL, MAGNUS I.

**MELAMED, MYRON**, PANTONE, ANTON M., and WILLIAMS, JACK: Adult megacolon without obstruction (ab), May, 848

**MELANIN**  
 —pigmentation  
 —duodenal polyposis associated with mucocutaneous melanosis (Peutz-Jeghers syndrome) (ab), Arthur S. Tucker and Robert P. Bolande, Jan., 154

**MELANOMA**. See Tumors, melanoma

**MELCHING, HANS-JOACHIM**. See LANGENDORFF, HANS

**MELCHIOR, JOHANNES C.**, BENDA, CLEMENS E., and YAKOVLEV, PAUL I.: Familial idiopathic cerebral calcifications in childhood (ab), April, 659

**MELHEM, R. E.**, DUNBAR, J. D., and BOOTH, R. W.: The "B" lines of Kerley and left atrial size in mitral valve disease. Their correlation with the mean left atrial pressure as measured by left atrial puncture, Jan., 65

**MELLINGER, RAYMOND C.** See SMITH, RICHMOND W., Jr.

**MEMBRANES**. See Cricothyroid Membrane

**MEMORIAL FUND LECTURE**. See Radiological Society of North America

**MENASHE, VICTOR**. See STARR, ALBERT

**MENDEL, WALTER H.**, and **HORTENSTINE, CLARENCE B.**: Carcinoid of the jejunum (ab), Jan., 155

**MENINGES**  
 See also Arachnoid  
 —tonic muscle spasms and blood pressure changes following subarachnoid injection of contrast media. Experimental study in dogs with injection of Kontrast U and mixtures of Kontrast U and Xylocaine (ab), B. Funkquist and N. Obel, April, 687

**hemorrhage**  
 —bilateral anomalies of middle cerebral artery in recurrent subarachnoid hemorrhage: case (ab), Olle Höök and Georg-Fredrik Saltzman, Feb., 312

**tumors**  
 —symptomatology and neuroradiologic diagnosis of parasagittal meningioma (ab), G. Gauthier, Feb., 312

—vertebral angiography in diagnosis of meningioma within lateral ventricle (ab), Vincent Rogers, March, 493

**MENINGIOMA**. See Meninges, tumors

**MENISCOPHY**. See Knee, roentgenography

**MENOPAUSE**  
 —artificial  
 —artificial menopause with aid of ionizing rays (ab), Alfred Kratochwil et al, March, 522

**MENTASTH. P.** See COTTAFAVI, M.

**MERRIAM, GEORGE R., Jr.** See FOCHT, ELIZABETH F.

**MERRILL, MALCOLM D.** See VAETH, JEROME M.

**MESCHAN, I.** See WHITLEY, JOSEPH E.

—See WITCOFSKI, RICHARD L.

**MESENTERY**  
 —persistent descending mesocolon (ab), Leon Morgenstern, Jan., 157

**infarction**  
 —experimental study of diagnosis of mesenteric infarction (ab), Karel E. Absolon et al, March, 505

**MESOCOLON**. See Mesentery

**METABOLISM**  
 See also Iodine and Iodine Compounds; Nucleins; Thyroxine  
 —prompt effects of high-level irradiation on animal metabolism (ab), James P. Ellis, Jr., et al, April, 697

**METACARPUS**  
 —short metacarpal or metatarsal bones: pseudopseudohypoparathyroidism (ab), H. Hortling et al, Feb., 332

**METASTASES**. See Cancer, metastases; Tumors, metastases

**METATARSUS**  
 —short metacarpal or metatarsal bones: pseudopseudohypoparathyroidism (ab), H. Hortling et al, Feb., 332

**METHYLIOTHOURACIL**. See Thiothiouracil

**MEYER, H.-ST.**, and **BUSCH, G.**: Carotid-basilar anastomosis associated with multiple aneurysms and other anomalies (ab), April, 660

**MEYER, WILLIAM G.**: Intravenous cholecysto-cholangiography in emergency abdominal diagnosis (ab), June, 988

**MICTURITION**. See Urination

**MIKITY, VICTOR G.** See WILSON, MIRIAM G.

**MILANESI, R.** See AMBESI IMPIOMBATO, G.

**MILCH, ELMER**. See CULVER, GORDON J.

**MILK**  
 —excretion of radioiodine in human milk (ab), John C. Weaver et al, May, 860

—investigation on strontium-90 content of fodder and milk (ab), Ekkehard Groos, March, 527

**MILLER, C. PHILLIP, HAMMOND, CAROLYN W., and ANDERLE, SONIA K.**: Studies on susceptibility to infection following ionizing radiation. V. Comparison of intraperitoneal and intravenous challenge at intervals following different doses of x-radiation (ab), April, 700

**MIN, BYONG SOK**. See SANDBERG, HERSCHEL

**MINOR, DWANE B.** See LAMB, JOHN H.

**MINTY, C. C. J.** See Van den BREK, H. A. S.

**MITCHELL, MARVIN L., and O'ROURKE, MARY E.**: Response of the thyroid gland to thiocyanate and thyrotropin (ab), Jan., 172

**MITRAL VALVE**

- “B” lines of Kerley and left atrial size in mitral valve disease: their correlation with mean left atrial pressure as measured by left atrial puncture, R. E. Melhem, J. D. Dunbar and R. W. Booth, Jan., 65
- roentgen evaluation of pulmonary artery pressure in mitral stenosis, Philip M. Johnson, Ernest H. Wood, Bernard S. Pasternack and Morris A. Jones, April, 541

**MOEL, MORRIS**. See MARK, LLOYD K.

**MOHANRAO, G. J.** See FOLSOM, T. R.

**MOLES**. See Uterus, hydatidiform mole

**MOLLIN, D. L.**: Malabsorption syndromes: a symposium. III. The haematological diagnosis of addisonian pernicious anaemia and the intestinal malabsorption syndrome (ab), April, 678

**MOLNAR, G.** See VAJDA, D.

**MOLNAR, WILLIAM**. See CHRISTOFORIDIS, ANTHIMOS J.

**MONCRIEF, WILLIAM H., Jr.** See HARDY, RICHARD W.

**MONES, ROBERT**: Vertebral angiography. An analysis of 106 cases, Feb., 230

**MONITORING DEVICE**. See Counters and Counting

**MONSTERS**

- roentgen investigation of pregnancy with triplets, including a twin thoracopagus (ab), G. Agati and D. Prigione, June, 989

**MONTEMARTINI, C.** See di GUGLIELMO, L.

**MONTGOMERY, R. D., and STANDARD, K. L.**: Albers-Schönberg's disease: A changing concept (ab), March, 512

**MOORE, E. B.** See SUIT, HERMAN D.

**MOORE, H. DENDY**: Radiology in surgery of the “acute abdomen” (ab), April, 674

**MORAN, THOMAS J.** See BRENT, LAWRENCE B.

**MOREY, GILBERTO, VEILIT, ERNESTO, CRUZ, HIPÓLITO, and BOISSET, GERARDO**: Duodenal ulcer in the child (ab), Jan., 154

**MORGAN, H. G.** See WALKER, W. F.

**MORGAN, RUSSELL H.**: The measurement of radiant energy levels in diagnostic roentgenology, June, 867

**MORGENSTERN, LEON**: Persistent descending mesocolon (ab), Jan., 152

**MORLOCK, CARL G.** See HUPPLER, EDWARD G.

**MORPHIS, OSCAR L.**: Teflon tube method of radium implantation (ab), Jan., 170

**MORRIS, GEORGE C., Jr., DE BAKEY, MICHAEL E., COOLEY, DENTON A., and CRAWFORD, E. STANLEY**: Surgical treatment of renal hypertension (ab), May, 845

**MORRISON, ROBERT**: Carcinoma of the bladder: its treatment by supervoltage x-ray therapy (ab), Feb., 341

**MORROW, ANDREW G.** See LONG, ROBERT T. L.

**MOSCA, LIDIO G., and DI RIENZO, NÉLIDA V.**: Diagnosis of radiology of the cystic duct (ab), April, 680

**MOSHER, DONN G.** See LOKEN, MERLE K.

**MOTLEY, HURLEY L.**: Pulmonary function impairment in pneumoconioses (ab), Feb., 315

**MOUTH**

- craniofacial origin, signs, and treatment of craniofacial angiomas (ab), James B. Campbell and Frank M. Hudson, June, 991
- cancer
  - analysis of sites and causes of treatment failures in squamous-cell carcinoma of oral cavity (ab), Gilbert H. Fletcher et al., Feb., 336
  - carcinomas of oral cavity (ab), John H. Lamb and Dwane B. Minor, March, 518
  - electron-beam therapy of malignant tumors of mouth and jaw (ab), Friedhelm Oberheuser et al., March, 518
  - end results and causes of failure in treatment of intraloral carcinoma (ab), Lewis W. Guiss and Ian Macdonald, Feb., 337
  - evaluation of failures in treatment of oral cancer (ab), Arthur G. James, Feb., 337

**MUCOSA**

- bioassay of host radiosensitivity, an index of radiotherapy applied to cervical carcinoma (ab), Hugh J. Davis et al., Feb., 339

**MOVARREKH, H.** See ROTH, H. W.

**MOVING BEAM THERAPY**. See Roentgen Therapy

**MUCCHI, L., LORENZI, G. L., and GOIDANICH, I. F.**: Differential diagnosis of benign and malignant tumors of the extremity with the aid of angiography (ab), May, 846

**MULAY, DATTATREYA**. See TRAENKE, H. L.

**MURPHREE, R. L., and PACE, H. B.**: The effects of prenatal radiation on postnatal development in rats (ab), June, 996

**MURPHY, CAROL J.** See NEBEL, BERNARD R.

**MURPHY, WILLIAM P., Jr.** See BOUCEK, ROBERT J.

**MURRAY, I. P. C., and McGIRR, E. M.**: Radioactive iodine studies in the diagnosis of Hashimoto's thyroiditis (ab), Feb., 343

**MURRAY, R. O.** See SWEETNAM, D. R.

**MURTAGH, FREDERICK, and KIRKPATRICK, JOHN A.**: Diagnostic approach to the infant with an enlarging head (ab), Jan., 142

**MUSCLES**

- tonic muscle spasms and blood pressure changes following subarachnoid injection of contrast media. Experimental study in dogs with injection of Kontrast U and mixtures of Kontrast U and Xylocaine (ab), B. Funkquist and N. Obel, April, 687
- sartorius
  - changes in membrane potentials, K content, and fiber structure in irradiated frog sartorius muscle (ab), Edgar B. Darden, Jr., March, 529

**MUSTARD, W. T.**: Scoliosis: diagnosis and natural history (ab), March, 513

**MUTATION**. See Heredity, mechanism

**MYCOSIS**. See Actinomycosis; Aspergillosis; Histoplasmosis

**MYELITIS**

- radiation myelitis (ab), John B. Dynes and Magnus I. Stedal, Jan., 176

**MYELOGRAPHY**. See Spinal Canal Roentgenography; Spine, intervertebral disks

**MYELOMA**. See Bones, marrow

**MYERS, JACK D.** See BRENT, LAWRENCE B.

**MYHILL, J.** See ODDIE, T. H.

**MYOCARDIUM**. See Heart

**MYOMA**. See Tumors, myoma

## N

**NADEAU, PIERRE J., ELLIS, F. HENRY, Jr., HARRISON, EDGAR G., Jr., and FONTANA, ROBERT S.**: Primary pulmonary angiomyolysis X (ab), Jan., 146

**NAGLER, RICHARD, WOLFSON, ALFRED W., LOWMAN, ROBERT M., and SPIRO, HOWARD M.**: Effect of gastric intubation on the normal mechanisms preventing gastroesophageal reflux (ab), April, 675

**NAGY, E.** See VAJDA, D.

**NASOPHARYNX**. See Pharynx

**NATHAN, M. H., and BLUM, LUIS**: Evaluation of vertebral venography (ab), April, 671

—See TENG, CHING TSENG

**NATIONAL COMMITTEE ON RADIATION PROTECTION AND MEASUREMENTS**. announcement concerning activities, Jan., 127

## NAVAL MEDICINE

- sarcoïdosis: experience at a naval hospital, C. Charles Welch and Robert O. Canada, March, 498
- NAVicular BONE. See Scaphoid Bone, Carpal
- NAZARENO, J. P., STUDENSKI, E. R., and PICKREN, J. W.
- The cholangiogram: postmortem study, Jan., 54
- NEBEL, BERNARD R., and MURPHY, CAROL J.
- Damage and recovery of mouse testis after 1000 r acute localized x-irradiation, with reference to restitution cells, Sertoli cell increase, and type A spermatogonial recovery (ab), June, 997

## NECK

- role of x-ray therapy to neck region in production of thyroid cancer in young people: 37 cases (ab), E. Hunter Wilson and Samuel P. Asper, Jr., April, 696
- thyroid cancer after irradiation in adult life (ab), A. M. Jelliffe and K. M. Jones, June, 995
- cancer
  - metastatic cancer of neck (ab), Zoilo Marinello, Jan., 165

**NECROSIS**. See Bones, necrosis; Gastrointestinal Tract, necrosis; Kidneys, necrosis; Lungs, effects of irradiation; Roentgen Rays, injurious effects; Spine, intervertebral disks

## NEEDLES

- afterloading technique with rigid needles in interstitial radiation therapy, Herman D. Suit, Robert J. Shalek, E. B. Moore, and J. Robert Andrews, March, 431
- multiple implant dosimetry, C. G. Amato, S. J. Malsky, V. P. Bond and B. Roswit, Feb., 292
- NELSON, ARNE. See HOLMBERG, BO
- NELSON, SIDNEY W., and EGGLESTON, WILLIAM
- Findings on plain roentgenograms of the abdomen associated with mesenteric vascular occlusion with a possible new sign of mesenteric venous thrombosis (ab), March, 504

## NEOSTIGMINE

- use of parenteral neostigmine in roentgen study of small bowel, Alexander R. Margulis and Paul Mandelstam, Feb., 223

## NEPHROPICTURE. See Kidneys, blood supply

## NEPHROSCLEROSIS

- late effects of x-radiation: influence of dose fractionation on life span, leukemia, and nephrosclerosis incidence in mice (ab), L. J. Cole et al., May, 862

## NEPHROTOMOGRAPHY. See Body-Section Roentgenography

## NERVES

- acoustic
  - radiologic appearance of acoustic neurinoma; review of 68 cases (ab), A. Cecchin, March, 493
- effects of irradiation
  - bioelectric activity of mammalian nerves during x-irradiation (ab), C. S. Bachofer and M. E. Gautereaux, June, 998
  - bioelectric responses in situ of mammalian nerves exposed to x-rays (ab), C. S. Bachofer and M. E. Gautereaux, March, 529

Vol. 76

## NERVES—cont.

## roots

—importance of cervical myelography in cervical and upper thoracic nerve root avulsion, William J. Varley, March, 376

—spondylosis of cervical spine with compression of spinal cord and nerve roots (ab), Paul Teng, Feb., 330

**NEURINOMA.** See Nerves, acoustic

## NEUROFIBROMATOSIS

—skeletal lesions in neurofibromatosis, James C. Hunt and David G. Pugh, Jan., 1

## NEURORADIOLOGY

See also Meninges, tumors

—neuroradiology course, Columbia University, New York, Feb., 305

## NEUTRONS

—calibration studies at medical therapy facility of Massachusetts Institute of Technology (MIT) reactor, Gordon L. Brownell, Charles Porter and Theos J. Thompson, Jan., 124

—effects of total-body irradiation of dogs with simulated fission neutrons (ab), E. L. Alpen et al., May, 865

—radiation effects of neutron-capture therapy on malignant vascular neoplasm of cerebellum: histopathological observations (ab), Stuart W. Lippincott et al., March, 517

—radioautoluminescent gamma-ray dosimetry of mixed neutron gamma-ray radiation fields, C. G. Amato and S. J. Malsky, Feb., 290. See also correction, May, 830

**NEWCOMBE, H. B.** See McGREGOR, J. F.

**NEWLAND, H. W., DAVIS, G. K., and WALLACE, H. D.**: Placental transfer of phosphorus in sows maintained on high and low levels of dietary manganese (ab), March, 526

**NEWMAN, HARRY R.** See CHOVNICK, STANLEY D.

**NEWSOME, BERNARD D., and KIMELDORF, DONALD J.**: Species differences in altitude tolerance following x-irradiation (ab), March, 529

**NEY, CHARLES.** See FRIEDENBERG, RICHARD M.

**NICKELL, LAWRENCE R.** See REAVIS, CHARLES W.

**NICOLAI, CHARLES H.**: Pyelorenal uptake in the normal and pyelonephritic kidney (ab), May, 856

## NIGERIA

—Salmonella osteitis in Nigerian children (ab), R. G. Hendrickse and Patrick Collard, May, 851

**NILSON, ARNE E.**: Roentgen diagnosis of ureterocele and some impeding factors (ab), Feb., 334

**NISHIMURA, EDWIN T.** See HEYSEL, ROBERT

**NOGUCHI, A.** See YAMAZAKI, E.

**NOLAN, ROBERT B., HAYLES, ALVIN B., and WOOLNER, LEWIS B.**: Adenoma of the parathyroid gland in children. Report of case and brief review of the literature (ab), April, 659

**NOMURA, TAKAYOSHI.** See MATSUBARA, TOSHIO

**NORDENSTRÖM, BJÖRN, and NOVEK, JAAN.**: The aetiological complex of the left lung (ab), Jan., 145

**NORDIN, B. E. C.** See BARNETT, ELLIS

**NORMAN, ALEX, and SAGHATOLESAMI, MEHDI.**: Oral extrahepatic cholangiography: a simple reliable technic, May, 801

## NOSE

—nasopharyngeal fibroma: its malignant potentialities and radiation therapy (ab), G. E. Massoud and H. K. Awwad, June, 992

**NOVEK, JAAN.** See NORDENSTRÖM, BJÖRN

**NOVELL, P. C.** See COLE, LEONARD J.

## NUCLEINS

—DNA synthesis in irradiated hair follicles of mouse (ab), S. M. Cattaneo et al., June, 997

—effect of x-radiation on DNA metabolism in various tissues of the rat. II. Recovery after sublethal doses of irradiation (ab), Oddvar F. Nygaard and Richard L. Potter, May, 866

—effect of x-radiation on DNA metabolism in various tissues of the rat. III. Retention of labeled DNA in normal and irradiated animals (ab), Oddvar F. Nygaard and Richard L. Potter, May, 866

**NUEROFF, MARVIN.** See SCHTEINGART, DAVID E.

—See SLATER, STANLEY

## NUTRITION

—relation of small-bowel resection to nutrition in man (ab), M. H. Kalser et al., Feb., 323

**NYGAARD, ODDVAR F., and POTTER, RICHARD L.**: Effect of x-radiation on DNA metabolism in various tissues of the rat. II. Recovery after sublethal doses of irradiation (ab), May, 866

Effect of x-radiation on DNA metabolism in various tissues of the rat. III. Retention of labeled DNA in normal and irradiated animals (ab), May, 866

**NYHUS, LLOYD M.** See STEVENSON, JOHN K.

## O

**OBEL, N.** See FUNKQUIST, B.

**ÖBERHEUSER, FRIEDHELM, SCHUBERT, GERHARD, SCHUCHARDT, KARL, and SPIESSL, BERNHARD.**: Electron-beam therapy of malignant tumors of the mouth and jaw (ab), March, 518

—See SCHUBERT, GERHARD

## OBITUARIES

**Bogart, Franklin Blevins, May, 831**

**Brown, Samuel, April, 647**

**Cushway, Bertram Charles, Feb., 303**

**Gould, David M.**, June, 976

**Heacock, Charles Hunter, March, 484**

**Heatley, John Evans, March, 485**

## OCIPITAL BONE

—occipital dermal sinus: clinical and radiological findings when a complete occipital dermal sinus is associated with a dermoid cyst (ab), George F. Smith and Donald H. Altman, Jan., 142

## OCEANOGRAPHY

—radiological physics at an oceanographic institution, T. R. Folsom, R. A. Cramer and G. J. Mohanrao, Jan., 121

**OCH, MICHAEL.** See SHAPIRO, JEROME H.

**OCHSNER, ALTON.** See OCHSNER, SEYMOUR FISKE

**OCHSNER, SEYMOUR FISKE, and OCHSNER, ALTON.**: Benign neoplasms of the gallbladder: diagnosis and surgical implications (ab), March, 510

**O'CONNELL, JOHN E. A.**: Intervertebral disk protrusions in childhood and adolescence (ab), March, 513

**ODDIE, T. H., THOMAS, I. D., RUNDLE, F. F., MYHILL, J., and CATT, B.**: Diagnostic limits for thyroidal radioiodine uptake rates (ab), Feb., 342

## ODONTOID PROCESS

—See Atlas and Axis

**OLIVILIE, COLIN.** See FOUCHE, R. F.

**O'LACO, J. P., and WILCOX, WILLIAM A.**: A comparative clinical evaluation of a new oral cholecystographic medium, Orabilex, with Telepaque (ab), March, 509

## OLD AGE

—on the incidence of senile osteoporosis (ab), Richmond W. Smith, Jr., et al., April, 681

—relationship between ulcers in aged and radiologically demonstrated calcification of left gastric artery (ab), J. Holstein and A. Stecken, April, 676

—transverse diameter of heart in older people (ab), Nairn R. Cowan, April, 664

**OLSEN, ARTHUR M.** See HARRISON, EDGAR G., Jr.

**ONTKO, JOSEPH A.**: Relation of hepatic ketogenesis to radiation-induced decrease in fasting ketonemia (ab), Feb., 350

**OPPENHEIM, H., and WING, M.**: Sialography and surface anatomy of the parotid duct (ab), March, 495

## OPTIC CANAL

—technic for examination of optic foramina (ab), Giovanni Ruggiero, Jan., 143

**ORABILEX.** See Gallbladder, roentgenography

**ORBIT** —roentgenologic manifestations of fracture of orbital floor (blow-out fracture) (ab), J. R. Lewin et al., Feb., 313

## ORGANS

—relative biological efficiency of 20 Mev and 4 Mev radiations. Report from the Medical Research Council Group, Christie Hospital, Manchester 20 (England). VI. Experiments on organ weight loss and 50 per cent mortality in mice (ab), Edith Paterson and D. D. Porteous, March, 530

**ORMOND, ROBERT S., POZNANSKI, ANDREW E., and TEMPLETON, ARCH W.**: Pulmonary veins in congenital heart disease in the adult, June, 885

**ORNDOFF, BENJAMIN H.**, honored, Jan., 130

**O'Rourke, J., and Collins, Eleanor.**:  $P^{32}$  localization of malignant melanoma of the posterior choroid (ab), April, 694

**O'Rourke, Mary E.** See MITCHELL, MARVIN L.

**ORTHICON TUBE.** See Television

**ORVIS, ALAN L.** See BONNET, JOHN D.

**OS SUPRACORACOIDUM.** See Scapula

**OSGOOD-SCHLATTER'S DISEASE.** See Tibia, tuberosity

**OSHRAIN, CARL, and ROSENBERG, COLEMAN H.**: Localized obstructive emphysema produced by an extrabronchial lesion (ab), Jan., 144

**OSSICLES.** See Ear, ossicles

## OSTEITIS

—Salmonella osteitis in Nigerian children (ab), R. G. Hendrickse and Patrick Collard, May, 851

—simultaneous occurrence of osteitis deformans and Hodgkin's disease (ab), Arthur E. Davis, Jr., March, 512

**OSTEOARTHRITIS.** See Femur

**OSTEOCHONDRITIS.** —early recognition of osteochondrosis of capital epiphysis of femur (ab), Bernard W. Jacobs, Jan., 161

**OSTEOCHONDROMATOSIS.** See Joints, loose bodies in

**OSTEOCLASTOMA.** See Tumors, osteoclastoma

**OSTEODYSTROPHY.** See Dwarfism

**OSTEOGENESIS.** See Bones, growth

**OSTEOGENESIS IMPERFECTA.** See Bones, fragility

**OSTEOMYELITIS.** See Spine

**OSTONECROSIS.** See Bones, necrosis

**OSTEOPOROSIS.** See Bones, atrophy

**OSTEOSCLEROSIS** —fragilis

—Albers-Schönberg's disease: a changing concept (ab), R. D. Montgomery and K. L. Standard, March, 512

**OSTIUM PRIMUM; OSTIUM SECUNDUM.** See Heart, abnormalities

**OSTRUM, BERNARD J.** See RUBIN, ROBERT J.

**OTOMO, EIICHI, VAN BUSKIRK, CHARLES, and WORKMAN, JOSEPH B.**: Circulation of the spinal cord studied by autoradiography (ab), Jan., 174

**OTOSCLEROSIS** —radiologic findings in otosclerosis (ab), W. E. Compere, Jr., March, 495

**OVADIA, J., and McALLISTER, J.**: Dose distribution in grid therapy with 15- to 33-Mev electrons, Jan., 118

## OVARY

See also Gonads

—studies on radiation-induced mammary gland neoplasia in rat. I. Role of ovary in neoplastic response of breast tissue to total- or partial-body x-irradiation (ab), E. P. Cronkite et al., April, 701

## abnormalities

—pneumopelvigraphy of developmental malformations of female internal genitalia (ab), M. Henzl et al., Jan., 162

## effects of irradiation

—artificial menopause with aid of ionizing rays (ab), Alfred Kratochwil et al., March, 522

—value of an early change in hormonal status through suspension of ovarian function and application of androgens in therapy of advanced mammary carcinoma: experiences with prophylactic x-ray castration in 284 patients (ab), Hanno Poppe and Anton Gregl, March, 519

## tumors

—dysgerminoma of ovary: unusual roentgen manifestation of metastases (b), S. B. Feinberg, March, 522

**OWEN, CHARLES A., Jr., McCONAHAY, WILLIAM M., CHILDS, DONALD S., Jr., and MCKENZIE, BERNARD F.:** Serum "thyroglobulin" in thyroidal carcinoma (ab) Jan., 172

—See **BONNET, JOHN D.**

—See **CAWEIN, MADISON J., III**

**OWEN, EDWARD E.** See **JANSSEN, BENNO, Jr.**

**OWEN, K.** See **BROWN, J. J.**

**OWEN, R. H.:** The concentration of pyelographic contrast media. A radiographic method of estimation of renal function (ab), June, 989

**OWEN, RAY D.** See **GOODMAN, JOAN WRIGHT**

## OXYGEN

—biochemical effects of internal irradiation (ab), Charles C. Irving and Jessie D. Perkins, Jr., June, 996

—quantitative measurements of oxygen tension in normal tissues and in tumors of patients before and after radiotherapy (ab), Donald B. Carter and Ian A. Silver, Jan., 177

—radiologic considerations of the perinatal distress syndrome, Edward B. Singleton, Harvey M. Rosenberg and Luis Samper, Feb., 200

## P

**PACE, H. B.** See **MURPHREE, R. L.**

**PACK, GEORGE T.** See **ARIEL, IRVING M.**

**PAIN.** See **Backache; Stomach, volvulus; etc.**

**PAINTER, WILLIAM E.** See **WITCOFSKI, RICHARD L.**

**PALMER, JOHN D.** See **BERNSTEIN, EUGENE F.**

**PALMER, WALTER L.** See **RAMOS, ALBERTO RAMIREZ**

**PALUBINSKAS, A. J.:** Medullary sponge kidney, June, 911

—and **WYLIE, EDWIN J.:** Roentgen diagnosis of fibromuscular hyperplasia of the renal arteries, April, 634

## PANCREAS

See also **Diabetes Mellitus; Pancreatic Ducts**

## abnormalities

—contribution to roentgen diagnosis of annular pancreas with reports of 2 cases, 1 with an unusually large duodenal dilatation (ab), R. Walko, Feb., 326

## preparations

— $^{131}$ I-labeled fat and pancreatin as a differential absorption test in patients with steatorrhea (ab), Abraham A. Polachek and Robert F. Williard, April, 693

## PANCREATIC DUCTS

—operative pancreatography (ab), Mark A. Hayes, Feb., 325

**PANCREATIN.** See **Pancreas, preparations**

**PANCREATOGRAPHY.** See **Pancreatic Ducts**

**PANNACCIULLI, L.** See **FIESCHI, A.**

**PANTONE, ANTON M.** See **MELAMED, MYRON**

**PAQUIN, ALBERT J., Jr., MARSHALL, VICTOR F., and McGOVERN, JOHN H.:** The megacystis syndrome (ab), March, 516

## PARALDEHYDE

—effect of intravenous paraldehyde as recorded by chest x-ray film; case (ab), Jerome A. Gold et al., April, 663

**PARALYSIS.** See **Bladder, paralysis; Paraplegia**

## PARAPLEGIA

—uretric reflex in paraplegic (ab), J. Cosbie Ross et al., March, 515

## PARASITES

See also **Amebiasis; Ascariasis; Lungs, echinococcosis; etc.**

**Pneumocystis carinii.** See **Pneumonia, in children**

## PARATHYROID

## hyperparathyroidism

—advanced skeletal changes in hyperparathyroidism (ab), Richard M. Friedenberg and Victor Sayegh, Feb., 328

—primary hyperparathyroidism (ab), Ching Tseng Teng and M. Herbert Nathan, Feb., 328

—skull in hyperparathyroid bone disease (ab), Kent Ellis and Robert J. Hochstim, Feb., 312

## hypoparathyroidism

—short metacarpal or metatarsal bones: pseudopseudohypoparathyroidism (ab), H. Hortling et al., Feb., 332

## tumors

—adenoma of parathyroid gland in children; report of case and brief review of literature (ab), Robert B. Nolan et al., April, 659

**PARK, S. D. SCOTT.** See **BURNETT, W.**

**PARKER, ROBERT G., and HOLYOKE, JOHN B.:** Tumors of the testis (ab), Jan., 168

## PAROTID GLAND

—sialography and surface anatomy of parotid duct (ab), H. Oppenheim and M. Wing, March, 495

**PARS MEMBRANACEA.** See **Trachea**

**PARTINGTON, PHILIP F.** See **SACHS, MAURICE D.**

**PASSERINI, A.** See **LOMBARDI, G.**

**PASTERNAK, BERNARD S.** See **JOHNSON, PHILIP M.**

**PATELLA**

—erosion of femoral shaft due to patello-femoral osteoarthritis (ab), Colin Alexander, March, 514

—stress fractures of patella (ab), M. B. Devas, Jan., 161

**PATERSON, EDITH, and PORTEOUS, D. D.:** The relative biological efficiency of 20 MeV and 4 MeV radiations. A report from the Medical Research Council Group, Christie Hospital, Manchester 20 (England), VI. Experiments on organ weight loss and 50 per cent mortality in mice (ab), March, 530

**PATERSON, RALSTON:** The relative biological efficiency of 20 MeV and 4 MeV radiations. A report from the Medical Research Council Group, Christie Hospital, Manchester 20 (England), I. Introduction. VII. General review (ab), March, 530

**PATTERSON, STUART A.:** Disease conditions in animals, with radiographic findings, that are also present in man, May, 818

**PAVEK, E. J.** See **LEWIN, J. R.**

**PAZ-CARRANZA, JULIO.** See **SLATER, STANLEY**

**PEARL, W. S.** See **BROWN, J. J.**

**PEDIATRICS.** See **Children; Infants, Newborn**

**PELVIMETRY.** See **Pelvis, measurement**

## PELVIS

See also under names of pelvic bones and organs

## blood supply

—effect of radiation on metastatic pelvic lymph nodes judged by pelvic venograms, Sumner Holtz, William E. Powers and Alfred J. Sherman, Feb., 287

—pelvic arteriography in gynecologic conditions (ab), N. Macarini et al., June, 988

—varicocèle of broad ligament: a venographic study (ab), C. G. Helander and Å. Lindbom, Jan., 163

irradiation. See **Uterus, cancer**

## measurement

—radiologic pelvimetry (ab), Ulf Borell and Ingemar Fernström et al., May, 853

roentgenography. See also **Pelvis, measurement**

—pneumopelvigraphy of developmental malformations of female internal genitalia (ab), M. Henzl et al., Jan., 162

—roentgen investigation of pregnancy with triplets, including a twin thoracopagus (ab), G. Agati and D. Prigione, June, 989

## tumors

—extradural osseous lesions simulating the disk syndrome (ab), Harry R. Walker, Jan., 160

—identification of pelvic masses by phlebolith displacement (ab), Howard L. Steinbach, April, 673

## PENIS

## cancer

—carcinoma of penis; clinical study of 229 cases (ab), Folke H. Edsmyr and Tore Ekström, Jan., 170

## PEPTIC ULCER

—evaluation of Einhorn string test (ab), J. A. Ewart et al., May, 848

—gastric retention during oral cholecystography due to underlying lesion of stomach and duodenum (ab), P. Ruben Koehler et al., Feb., 323

—relationship between ulcers in the aged and radiologically demonstrated calcification of left gastric artery (ab), J. Holstein and A. Stecken, April, 676

—x-ray negative dyspepsia: follow-up study (ab), Pekka Brummer and Ilkka Häkkinen, Jan., 153

## in children

—duodenal ulcer in the child (ab), Gilberto Morey et al., Jan., 154

—peptic ulcer in children: review of literature and report of 32 cases (ab), Alberto Ramirez Ramos et al., Jan., 153

## perforated

—perforated peptic ulcer: radiological review of 50 consecutive cases (ab), Charles Stuart, April, 676

## surgical therapy

—etiology and management of dumping syndrome following gastroenterostomy or subtotal gastrectomy (ab), William E. Abbott et al., May, 847

—roentgenologic diagnosis of gastrocilic and gastrojejunocolic fistulas (ab), Robert H. Thoeny et al., April, 677

therapy. See also **Peptic Ulcer, surgical therapy**

—effect of roentgen therapy on gastric acidity: clinical and experimental studies (ab), James Y. McCullough, Jan., 176

**PERALES, LUIS A.** See **HARDY, RICHARD W.**

**PERCHIK, LAWRENCE.** See **HEITZMAN, E. ROBERT**

## PERCUSSION

—percussion of sternum. I. Aid to differentiation of peri-cardial effusion and cardiac dilatation (ab), William Dressler, April, 666

## PERFUSION

—continuous monitored dialysis-perfusion device for study of two compartment systems, Ervin Kaplan and John J. Maris, Jan., 123

## PERIARTERITIS NODOSA

—periarteritis nodosa with labile and recurrent pleuro-pulmonary manifestations without asthma or serum hyper-eosinophilia (ab), J. Turiel et al., Feb., 316

**PERIARTERITIS NODOSA**—cont.  
—roentgen changes in thorax in periarteritis nodosa (ab), K.-H. Vogel and E. Flink, March, 499

**PERICARDITIS**  
with effusion  
—percussion of sternum. I. Aid to differentiation of pericardial effusion and cardiac dilatation (ab), William Dressler, April, 666

**PERICARDIUM**  
diseases  
—gas and opaque contrast in roentgenographic diagnosis of pericardial disease (ab), Herbert M. Staufer et al., Jan., 148  
effusion. See Pericarditis

**PERITONEUM**  
effusion. See Effusions

**PERKINS, HENRY T., Jr., McINTOSH, HENRY D., and BOINEAU, JOHN P.**: Goitre plongeant: intrathoracic goiter demonstrated by the Valsalva maneuver (ab), Jan., 142

**PERKINSON, JESSE D., Jr.** See IRVING, CHARLES C.

**PERLMANN'S TUMOR.** See Kidneys, tumors

**PERLMUTTER, MARTIN.** See SCHTEINGART, DAVID E.

—See SLATER, STANLEY

**PERMACHON TUBE.** See Throat

**PERNICIOUS ANEMIA.** See Anemia, pernicious

**PERRYMAN, C. RICHARD, McALLISTER, JOHN D., and BURWELL, JAMES A.**: Cobalt 60 radiography (ab), Jan., 175

**PERSKY, LESTER.** See KAZMIN, MARVIN

**PETER, JAMES B.** See BALDUS, WILLIAM P.

**PETERSEN, OLAF.** See BRÜNNER, S.

**PETRANY, ZOLTAN.** See IBARRA, JESSE D., Jr.

**PEUTZ-JEGHERS SYNDROME.** See Tumors, polypi

**PFAU, A.** See SCHWARTZ, A.

**PHARYNX**  
cancer  
—wedge filters in roentgen therapy of carcinoma of larynx and hypopharynx (ab), Sigrard Kaae and Niels Brene, Jan., 166  
diverticula  
—endoscopic operation for hypopharyngeal diverticula: a roentgenographic study (ab), Gösta Dohlman and Ove Mattsson, March, 494

roentgenography  
—x-ray study of passage of air through pharynx in anesthetized patients (ab), H. Ruben et al., June, 986

tumors  
—nasopharyngeal fibroma: its malignant potentialities and radiation therapy (ab), G. E. Massoud and H. K. Awwad, June, 992

**PHENYLTHIOUREA.** See Thiourea

**PHEOCHROMOCYTOMA.** See Adrenals, tumors

**PHLEBOGRAPHY.** See Extremities, blood supply

**PHLEBOLITH.** See Veins, calculi

**PHOSPHORUS.** See Radioactivity, radiophosphorus

**PHOTOFLUOROGRAPHY.** See Lungs, cancer

**PHOTOGRAPHS AND PHOTOGRAPHY**  
—photographic method of measuring fluoroscopic dose to the patient, Hanson Blatz and Edward R. Epp, Jan., 120

**PHYSICIANS**  
—statistics and the physician (ed), Christian V. Cimmino, Jan., 128. See also letter to editor, R. R. Newell, May, 831

**PHYSICS**  
See also Radiations; Radioactivity; Roentgen Rays, physics  
—American Association of Physicists in Medicine, March, 486  
—radiologic physics course, Columbia University, New York, April, 649

**PIATT, ARNOLD D.** See ERHARD, GERALD A.

**PICKERING, JOHN E.** See ELLES, JAMES P., Jr.

**PICKREN, J. W.** See NAZARENO, J. P.

**PIERCE, FRANK T., Jr., and HANAFEE, WILLIAM.** Calcified cervical discs in a child (ab), Feb., 331

**PIERQUIN, B., and GASIOROWSKI, M.**: Technique of irradiation of epitheliomas of the tonsil by combined external high-energy roentgen therapy (betatron, 22 Mev) and interstitial curie therapy (Au-198 wires). Application of the concept of two-volume-targets (ab), April, 689

**PIGEON, G., LEFEBVRE, R., CARTIER, G. E., and GENEST, J.**: Unilateral renal damage after translumbar aortography (ab), May, 844

**PINEAL BODY**  
—assessment of methods for determination of position of pineal gland in lateral skull roentgenograms (ab), C. B. Lamont and D. G. Wollin, May, 839

**PINKERTON, HENRY.** See GREIFF, DONALD

**PIRSON, HERBERT S.** See CULVER, GORDON J.

**PITMAN, R. G.** See LAWS, J. W.

**PITTMAN, HELEN S.** Gamma globulin concentrations in ambulatory patients with bronchiectasis. A survey with report of one case of agammaglobulinemia treated for four years (ab), March, 501

**PITUITARY BODY**  
See also Cushing's Syndrome; Pituitary Preparations; Sella Turcica  
diseases. See Acromegaly  
irradiation. See also Pituitary Body, tumors  
—pituitary irradiation for acromegaly, Glenn E. Sheline, Minnie B. Goldberg and Robert Feldman, Jan., 70

tumors  
—cranio-buccal origin, signs, and treatment of craniopharyngiomas (ab), James B. Campbell and Frank M. Hudson, June, 991

—remission of Graves' disease following radiotherapy of pituitary neoplasm (ab), Joseph W. Jailer and Donald A. Holub, Feb., 338

**PITUITARY PREPARATIONS**  
—response of thyroid gland to thiocyanate and thyrotropin (ab), Marvin L. Mitchell and Mary E. O'Rourke, Jan., 172

**PLACENTA**  
—indirect effect of irradiation on embryonic development. II. Irradiation of placenta (ab), Robert L. Brent, May, 864

—intravenous placentalography (ab), Robert C. Goodlin et al., June, 989

—localizing the placenta with radioactive iodinated human serum albumin, Fred C. Heagy and Donald P. Swartz, June, 936

—placental transfer of phosphorus in sows maintained on high and low levels of dietary manganese (ab), H. W. Newland et al., March, 526

—transfer of zinc 65 across the placenta and fetal membranes of rabbit (ab), Carolyn W. Terry et al., Feb., 346

**PLACENTOGRAPHY.** See Placenta

**PLATYBASIA**  
—diagnostic criteria of basilar impression, Vincent C. Hinck, Carl E. Hopkins and Bhim S. Savara, April, 572

**PLENK, HENRY P., SORENSEN, FRED M., and FUSON, ROGER B.**: Do estrogenic and androgenic hormones affect the radiation reaction of tumors? Feb., 270

**PLEURA**  
—periarteritis nodosa with labile and recurrent pleuropulmonary manifestations without asthma or serum hypereosinophilia (ab), J. Turjai et al., Feb., 316

calcification  
—pleural calcification as roentgenologic sign of nonoccupational endemic anthophyllite-asbestosis (ab), Raimo Kiviluoto, April, 662

cancer  
—primary pleural cancers: attempt at classification of primary pleural tumors (ab), R. Even and Ch. Sors, Feb., 318

effusion. See Effusions; Pleurisy, with effusion

**PLEURISY**  
with effusion  
—intraoperative pleural effusion (ab), Robert A. Flaherty and James M. Keegan, May, 842

**PLUTONIUM**  
—employment of ion-exchange resins for removal of plutonium from gastrointestinal tract (ab), V. A. Belyaev, Feb., 346

**P-N JUNCTION SEMICONDUCTOR RADIATION DETECTOR.** See Radioactivity, apparatus

**PNEUMATOSIS CYSTOIDES INTESTINALIS.** See Intestines, cysts

**PNEUMATURIA.** See Urine, gases

**PNEUMOCOINIOSIS**  
—current concepts of pneumocoinioses—clinical aspects (ab), O. A. Sander, Feb., 315

—pulmonary function impairment in pneumocoinioses (ab), Hiley L. Motley, Feb., 315

**PNEUMOCYSTIS.** See Pneumonia, in children

**PNEUMOENCEPHALOGRAPHY.** See Brain, roentgenography

**PNEUMONITIS**  
See also Pneumonia  
—eosinophilic pneumonia; 2 cases with pulmonary biopsy, (ab), Anthimos J. Christoforidis and William Molnar, March, 498

in children  
—changes in pneumonia in children as seen on chest film (ab), E. Willrich, March, 497

—roentgen findings in Pneumocystis carinii pneumonia, S. B. Feinberg, R. G. Lester and B. A. Burke, April, 594

lipid  
—lipid pneumonia associated with paraesophageal hernia: angiographic study of case (ab), Israel Steinberg, Jan., 145

**PNEUMONITIS**  
See also Pneumonia  
—irradiation pneumonitis in treatment of carcinoma of breast (ab), M. N. Lougheed and G. H. Maguire, Feb., 346

**PNEUMOPELVIGRAPHY.** See Pelvis, roentgenography

**POCK-STEEN, O. CH.** See BRÜNNER, S.

—See DIVEPEVEEN, W. P.

**POINTON, R. C. S.**: Some clinical aspects of megavoltage. Bladder carcinoma (ab), Feb., 340

**POLACHEK, ABRAHAM A., and WILLIARD, ROBERT F.**:  $^{131}\text{I}$ -labeled fat and pancreatin as a differential absorption test in patients with steatorrhea (ab), April, 693

**POLL, MARVIN.** See SEITCHIK, MURRAY W.

**POLLERO, HECTOR J.** See LOCKHART, JORGE

**POLLOCK, FREDERIC J.** See GYORKEY, JOSEPH

**POLLOCK, VICTOR.** See DUNBAR, J. SCOTT

**POLYCYTHEMIA VERA**  
—incidence of leukemia in patients with polycythemia vera treated by  $^{132}\text{I}$  (ab), E. M. Ledlie, Feb., 344

**POLYMERIZATION DOSIMETER.** See Dosimeters and Dosimetry

**POLYPI.** See Tumors, polypi

**P-O-MAT.** See Urethra, roentgenography

**PONKA, JOSEPH L., BRUSH, BROCK E., and FOX, J.**  
DeWITT: Differential diagnosis of carcinoma of the sigmoid and diverticulitis. Evaluation of aids (ab), Jan., 156

**PONTIFEX, A. H.** See LAMERTON, L. F.

**POPPE, HANNO, and GREGL, ANTON:** Value of an early change in hormonal status through suspension of ovarian function and application of androgens in the therapy of advanced mammary carcinoma. Experiences with prophylactic x-ray castration in 284 patients (ab), March, 519

**POPPET, M. H.:** Duodenocolic apposition (ab), March, 507

**PORTAL VEIN:**

- gas embolization of portal venous system (ab), Noah Susman and Hyman R. Senter, March, 505
- portal hypertension: its diagnosis, therapy, and prognosis (ab), E. Berchtold, Jan., 151
- supradiaphragmatic transposition of the spleen for portal hypertension: an experimental and clinical study (ab), Henry L. Hoffman and Samuel O. Freedlander, Jan., 151
- total anomalous pulmonary venous drainage into the portal system, Bertram Levin and Harvey White, June, 894

**ROENTGENOGRAPHY:**

- percutaneous ileonportography in demonstration of liver masses (ab), Sture Stattin, Feb., 326
- percutaneous splenoportography, with additional comments on transhepatic venography (ab), Sherwin S. Zeid et al., April, 73

**PORTEOUS, D. D.:** See PATERNER, EDITH

**PORTER, CHARLES:** See BROWNELL, GORDON L.

**PORTER, EDWARD C.:** Osteogenesis in multiple myeloma: report of a case, March, 45

**POSITION:** in roentgenography. See Pyelography

**POSTERIOR FOSSA:**

- vertebral arteriography of benign tumors (ab), A. Isfort, April, 660

**POTASSIUM:**

- iodide:
  - potassium iodide screens and high-capacity roentgen tubes in angiography (ab), Erik Carlsson, April, 669

**POTSID, MAJIC S., IRIE, GORO, and GRISCOM, NATHAN T.:** Motility changes revealing esophagogastric junction, Feb., 262

**POTTER, G. D., LINDSAY, S., and CHAIKOFF, I. L.:** Induction of neoplasms in rat thyroid glands by low doses of radioactive iodine (ab), March, 522

**POTTER, RICHARD:** See NYGAARD, ODDVAR F.

**POTTS, D. G.:** See BULL, W. D.

**POWERS, E. L.:** See GREIFF, DONALD

**POWERS, WILLIAM E.:** See HOLTZ, SUMNER

**POZNANSKI, ANDREW K.:** See ORMOND, ROBERT S.

**PRABHASAWAT, DUSDEE:** See RUBIN, PHILIP

**PREDNISONE:** See Adrenocortical Preparations

**PREGNANCY:**

- See also Fetus; Pelvis, measurement; Pelvis, roentgenography
- transfer of strontium 90 from mother to fetus in mice (ab), T. Holmberg et al., May, 861

**PRESL, J.:** See HENZL, M.

**PRETTO, JOHANN I.:** See SCHWARZ, ENRIQUE

**PRIEST, ROBERT E., KOPPLITZ, R., MARLENE, and BEN-DITTE, EARL P.:** Estradiol reduces incorporation of radioactive sulfate into cartilage and aorta of rats (ab), May, 861

**PRIESTLEY, JAMES T.:** See HUPPLER, EDWARD G.

**PRIGIONE, D.:** See AGATI, G.

**PRITCHARD, A. E., and THOMPSON, W. A. L.:** Acute pyogenic infections of the spine in children (ab), Jan., 159

**PROCLOWN, JOHN J., and LOEWEN, DAVID F.:** Pulmonary aspergillosis with cavitation secondary to histoplasmosis (ab), May, 841

—See LOEWEN, DAVID F.

**PROCTER, N. M., and GREENING, J. R.:** On the adequacy of half-value layer as a criterion of x-ray quality in the calibration of dosimeters (ab), March, 523

**PROSTHESES:** See Arteries, surgery

**PROTEINOSIS:**

- asymptomatic pulmonary alveolar proteinosis (ab), William E. Furst et al., Feb., 317
- physiologic and clinical aspects of pulmonary alveolar proteinosis (ab), William Fraimow et al., April, 661
- pulmonary alveolar proteinosis (ab), William R. Edmondson and J. Brewster Gere, April, 662
- pulmonary alveolar proteinosis: case with fatal outcome (ab), Edgar G. Harrison, Jr., et al., March, 498
- pulmonary alveolar proteinosis: correlation of pathological and physiological findings in a patient followed up with serial biopsies of lung (ab), William Fraimow et al., Feb., 317

**PROTEINS:**

- See also Blood, proteins; Proteinosis
- in vitro leucine incorporation into protein of normal and x-irradiated rabbit bone marrow cells (ab), Edwin M. Uyeki et al., Feb., 349
- radioisotope concentration gradient analyzer—design and application, Rosalyn S. Yalow and Solomon A. Berson, Jan., 123
- studies on proteins of normal and diseased thyroid glands (ab), Leslie J. DeGroot and Evelyn Carvalho, Jan., 172

**PSEUDOPSEUDOHYPOPARATHYROIDISM:** See Parathyroid, hypoparathyroidism

**PUGH, DAVID G.:** See HUNT, JAMES CLEON

**PULMONARY VALVE:**

- mild pulmonary stenosis: clinical and hemodynamic study of 11 cases (ab), Stephen M. Ayres and Daniel S. Lukas, April, 666

**PURKAYASTHA, MANISH C.:** See FRIEDMAN, MILTON

**PUUPPONEN, E.:** See HORTLING, H.

**PYELOGRAPHY:**

- cineurography (ab), Robert A. Garrett and Eugene C. Klatte, Feb., 332
- concentration of pyelographic contrast media: radiographic method of estimation of renal function (ab), R. H. Owen, June, 989
- dangers of excretory urography (ab), Frank C. Hamm et al., Jan., 164
- equipment aids in intravenous pyelography, W. C. Smullen, J. W. Little, Jr., and F. A. Winters, March, 475
- excretory urogram as a kidney function test (ab), Chester C. Winter, Jan., 164
- experiences with Duografin (ab), William H. Shehadi, Feb., 336
- limitations of intravenous pyelogram as a test of renal function (ab), William W. Hoffman and John T. Grayhack, Feb., 333
- prone position in intravenous urography for study of upper urinary tract, Milton Elkin, June, 961
- pyelographic study of ureteric injuries sustained during hysterectomy for benign conditions (ab), Edward Solomons et al., May, 855
- retrograde pyelography (ab), Charles J. Staley, June, 990
- value of tomography in urographic study of infants and children (ab), Cl. Beraud et al., March, 515

**PYELONEPHRITIS:**

- pyelonephritis uptake in normal and pyelonephritic kidney (ab), Charles H. Nicolai, May, 856

**PYLE, ROGER, and SAMUEL, ERIC:** An evaluation of the hazards of barium enema examination (ab), May, 848

**PYLORUS:** See also Stomach

**Cancer:**

- carcinoma of pylorus simulating benign duodenal obstruction (ab), Charles H. Brown, Feb., 323

**PYTEL, ANTON:** Renal fornical hemorrhages: their pathogenesis and treatment (ab), April, 684

**PYYKONEN, L.:** See KOIVISTO, E.

## Q

QUASTLER, H. See CATTANEO, S. M.

QUILLIN, RALPH C.: Roentgenographic diagnosis of arthritis (ab), June 988

## R

RABINOVITZ, MARVIN J. See BOATMAN, JOSEPH B. RADFORD, REX. See DUNBAR, J. SCOTT

RADATIONS

See also Counters and Counting; Dosimeters and Dosimetry; Neutrons; Plutonium; Radioactivity; Radium; Roentgen Rays; Tritium; Uranium

—new simple radiation scanning system, T. Fields, G. Clayton and J. Kenski, Jan., 122

—space radiations: natural and man-made; Memorial Fund lecture, Payne S. Harris, April, 532

**effects:** See also Radiations, injurious effects

—effect of homologous bone marrow-spleen cell suspension on survival of swine exposed to radiation from a nuclear weapon (ab), Harry W. Daniel and William H. Crosby, April, 702

—in vitro effects of irradiation combined with actinomycin D, Paul Y. M. Chan and Edwin J. Liebner, Feb., 273

**injurious effects:** See also Atomic Bomb and Atomic Energy; Radiations, protection against; Roentgen Rays, injurious effects; Uranium, etc.

—effect of radiation upon heart (ab), Mary Catterall, Jan., 176

—factors influencing maximum permissible doses of radiations (ab), Robert S. Stone, May, 802

—geographical variation in leukemia mortality in relation to background radiation and other factors (ab), W. M. Court Brown et al., April, 697

—hazards of medical irradiation (ed), Robert J. Bloor, June, 970

—medical aspects of ambient radiations of extraterrestrial space (ab), Paul A. Campbell, Jan., 178

—testing of indoleamino compounds in prevention of radiation illness (ab), L. F. Semenov, March, 530

**physics:**

- relative biological efficiency of 20 MeV and 4 MeV radiations. Report from Medical Research Council Group, Christie Hospital, II. Physical aspects (ab), David Greene and John B. Massey, March, 530

**protection against:** See also Roentgen Rays, protection against

—conventional building materials as protective radiation barriers, E. Dale Trout, John P. Kelley and Arthur C. Lucas, Feb., 237

—National Committee on Radiation Protection and Measurements, announcement concerning activities, Jan., 127

—radiation: registration of sources (ab), Dell F. Dullum, Feb., 350

**RADIOACTIVE ISOTOPES:** See Radioactivity

**RADIOACTIVITY:**

- See also Neutrons; Plutonium; Radiations; Radium; Tritium; Uranium
- radiological physics at an oceanographic institution, T. R. Folsom, R. A. Cramer and G. J. Mohanrao, Jan., 121

## RADIOACTIVITY—cont.

Society of Nuclear Medicine, Southwestern Chapter, March, 486

**apparatus.** See also other subheads under Radioactivity

- a P-N junction semiconductor radiation detector for use with beta- and gamma-ray-emitting isotopes, N. A. Baily and J. W. Mayer, Jan., 116
- continuous monitored dialysis-perfusion device for study of two compartment systems, Ervin Kaplan and John J. Marisic, Jan., 125
- course, advances in clinical radioisotope instrumentation, Oak Ridge Institute of Nuclear Studies, April, 650
- injurious effects. See Radioactivity, radiocesium; Radioactivity, radiocobalt; Radioactivity, radiophosphorus; Thyroid, cancer; etc.
- radiothorium**
- prompt effects of high-level irradiation (from a Ba<sup>140</sup>-La<sup>140</sup> source) on animal metabolism (ab), James P. Ellis, Jr., et al., April, 697
- radioisotopes**
- studies with chlorothiazide tagged with radioactive carbon (C<sup>14</sup>) in human beings (ab), Herbert R. Brettell et al., May, 858
- cesium-137 beam therapy unit. I. Physical aspects (ab), B. M. Wheatley et al., May, 860
- cesium-137 beam therapy unit. II. Clinical impressions (ab), E. D. Jones, May, 860
- comparative effects of prenatal gamma radiation and x-irradiation on reproductive system of rat (ab), Benjamin H. Ershoff and Ved Brat, March, 530
- considerations of shielding for cesium-137 sources, containing cesium 134, R. A. Beique and M. N. Lougheed, Feb., 281
- design of cesium sources for teletherapy (ab), W. S. Eastwood, May, 860
- dual-purpose cesium unit for radiotherapy, C. L. Ash, D. J. Wright and H. E. Johns, Feb., 284
- effects of protracted irradiation on blood-forming organs of rat. Part I. Continuous exposure (ab), L. F. Lamerton et al., March, 528
- physical aspects of use of cesium fission products in teletherapy (ab), B. M. Wheatley, May, 860
- radiochromium**
- anemia of hepatic disease studied with radiochromium (ab), Madison J. Cawein, III, et al., Feb., 345
- behavior in the circulation of the radioactive pulmonary embolus and its application to the study of fibrinolytic enzymes (ab), Michael Hume et al., Feb., 346
- blood loss during adenoidectomy and tonsillectomy measured with radioisotopes (ab), R. L. Ruggles, April, 694
- isotope chromium 51: evaluation of selected anemias with radioactive material (ab), John H. Wineinger et al., Feb., 345
- pattern of erythrocyte destruction in hemolytic anemia, as studied with radioactive chromium (ab), S. M. Lewis et al., Feb., 345
- radioactive iron (and chromium) studies in patients with iron deficiency anemia with concurrent abnormal hemolysis (ab), M. C. Verloop et al., June, 994
- technical considerations in scintillation scanning of human spleen, Philip M. Johnson and John C. Herion, March, 438
- use of Cr<sup>51</sup> labeled red blood cells in study of splenomegaly and the sites of hemocathesis (ab), A. Fieschi et al., May, 859
- radiocobalt**
- accidental acute irradiation from cobalt 60 (ab), G. A. Elliott, April, 694
- acute effects of gamma radiation in primates (ab), Ralph G. Allen et al., June, 996
- analysis of the LD 50/30 as related to radiation intensity (ab), L. C. Logie et al., May, 863
- cobalt-60 depth-dose correction as determined by transmission dose measurements, R. J. Schulz, G. A. Cohen, J. P. Tsai and J. C. Evans, Jan., 117; May, 865
- cobalt-60 radiography (ab), C. Richard Perryman et al., Jan., 175
- comparison of three different methods of external irradiation, and their results, in the treatment of inoperable carcinoma of lung, Ruth J. Guttman, Jan., 83
- effect of whole-body radiation and infection on arterial replacement (ab), Richard W. Hardy et al., Feb., 350
- effects of prenatal radiation on postnatal development in rats (ab), R. L. Murphree and H. B. Pace, June, 996
- kinetics of intravenously injected radioactive vitamin B<sub>12</sub>: studies on normal subjects and patients with chronic myelocytic leukemia and pernicious anemia (ab), Eugene A. Brody et al., June, 995
- modes of radiation death in chick embryo. I. Acute syndromes (ab), S. P. Stearner et al., May, 865
- modes of radiation death in chick embryo. II. A model of lethal mechanisms (ab), S. A. Tyler and S. P. Stearner, May, 865
- physical aspects of cobalt-60 teletherapy using wedge filters. I. Physical investigations. II. Dosimetric considerations (ab), M. Cohen et al., March, 525
- practical uses for radiation polymerization dosimeter in radiation therapy, Frank E. Hoecker, Jan., 116
- quantitative studies of bone-marrow cells in early stages of final hemopoietic recovery in irradiated guinea-pigs (ab), P. F. Harris, Feb., 349
- radiation-induced gastrointestinal death in the monkey (ab), Stephen G. Wilson, Jr., Feb., 348
- relative biological effectiveness of cobalt-60 gamma rays and 220-kvp x-rays on viability of chicken eggs (ab), Merle K. Loken et al., May, 865
- treatment of carcinoma of cervix with radium and telecobalt (ab), G. Ambesi Imiombato et al., June, 993
- radiofluoride**
- renal excretion of radiofluoride in dog (ab), Curtis H. Carlson et al., March, 526
- radiogold**
- technic of irradiation of epitheliomas of tonsil by combined external high-energy roentgen therapy (betatron, 22 Mev) and interstitial curie therapy (Au<sup>198</sup> wires). Application of concept of two-volume targets (ab), B. Pierquin and M. Gasiorowski, April, 680
- radioiodine.** See also Goiter; Goiter, Exophthalmic; Thyroid
- absorption of I<sup>131</sup>-labeled lipids after intraduodenal administration: effect of lipid prefeeding (ab), Benno Janssen, Jr., et al., Jan., 174
- amniotic circulation studied with I<sup>131</sup> (ab), M. Cottafavi and P. Mentasti, March, 525
- blood loss during adenoidectomy and tonsillectomy measured with radioisotopes (ab), R. L. Ruggles, April, 694
- cerebral radioangiography (ab), F. Hawliczek et al., Jan., 175
- clinical assessment of intestinal fat-absorption using radioactive fat (ab), W. F. Walker et al., March, 524
- clinical evaluation of radioactive Diiodast renogram as screening test in hypertension (ab), Ralph A. Stratton and Antonio M. Garcia, March, 524
- excretion of radioiodine in human milk (ab), John C. Weaver et al., May, 860
- experimental study of diagnosis of mesenteric infarction (ab), Karel E. Absolon et al., March, 505
- hepatography and study of liver function by means of I<sup>131</sup>-tagged rose Bengal (ab), D. Zillotto, March, 524
- I<sup>131</sup> fat and pancreatic as a differential absorption test in patients with steatorrhea (ab), Abraham A. Polacheck and Robert F. Williard, April, 693
- I<sup>131</sup> triolein tolerance curves in patients with diabetes mellitus: their similarity to those observed in myocardial infarction (ab), Herschel Sandberg et al., April, 693
- iodine metabolism in hydatiform mole and choriocarcinoma (ab), J. Thomas Dowling et al., Jan., 173
- isotopic renogram: method, quantitative analysis, and clinical usefulness (ab), H. W. Roth et al., Feb., 344
- localizing the placenta with radioactive iodinated human serum albumin, Fred C. Heagy and Donald P. Swartz, June, 936
- measurement of myocardial blood flow: radioisotope techniques used in patients with normal and arteriosclerotic hearts after infarction (ab), Philip C. Johnson and Gunnar Sevelius, May, 857
- permeability of cerebral blood vessels in experimental allergic encephalomyelitis studied by radioactive iodinated bovine albumin (ab), M. Vulpe et al., Jan., 173
- pyelorenal uptake in normal and pyelonephritic kidney (ab), Charles H. Nicolai, May, 856
- radioautography of conduction system of dog's heart with I<sup>131</sup> (ab), Herman N. Uhley et al., March, 526
- radioisotope concentration gradient analyzer—design and application, Rosalyn S. Yalow and Solomon A. Berson, Jan., 123
- rapid screening method for I<sup>131</sup> fat-absorption test, Leonard Rosenthal, Feb., 241
- technical procedure in kidney examinations with radioactive isotopes (ab), N.-E. Säterborg, April, 695
- treatment of inoperable cancer of biliary system with radioactive (I<sup>131</sup>) rose Bengal (ab), Irving M. Ariel and George T. Pack, Jan., 173
- use of radioactive iodine labeled triolein in evaluation of fat absorption following cholecystectomy (ab), E. J. Fedor and Bernard Fisher, June 993
- radioiodium**
- overloading technic with rigid needles in interstitial radiation therapy, Herman D. Suit, Robert L. Shalek, E. B. Moore and J. Robert Andrews, March, 431
- radioiron**
- effect of corticosteroids and gluten-free diet on absorption of iron in idiopathic steatorrhea and celiac disease (ab), John Badenoch and Sheila T. Callender, June, 994
- life cycle of erythrocytes of irradiated animals studied by means of Fe<sup>59</sup> (ab), B. Bellion and L. Resegotti, May, 859
- radioactive iron studies in patients with iron deficiency anemia with concurrent abnormal hemolysis (ab), M. C. Verloop et al., June, 994
- radioactive iron technics in clinical practice (ab), Walter Lentino et al., May, 858
- rate of loss of radioiron from mouse and man (ab), John D. Bonnet et al., March, 526
- radiokrypton**
- intercardiac injection of radioactive krypton: clinical applications of new methods for characterization of circulatory shunts (ab), Robert T. L. Long et al., May, 858
- radiolanthanum**
- prompt effects of high-level irradiation (from a Ba<sup>140</sup>-La<sup>140</sup> source) on animal metabolism (ab), James P. Ellis, Jr., et al., April, 697
- radiophosphorus**
- biochemical effects of internal irradiation (ab), Charles C. Irving and Jesse D. Perkinson, Jr., June, 996

**RADIOACTIVITY, radiophosphorus**—*cont.*  
 —circulation of spinal cord studied by autoradiography (ab), Eiichi Otomo et al., Jan., 174  
 —incidence of leukemia in patients with polycythemia vera treated by  $P^{32}$  (ab), E. M. Ledlie, Feb., 344  
 — $P^{32}$  localization of malignant melanoma of posterior choroid (ab), J. O'Rourke and Eleanor Collins, April, 694  
 —palliation of osseous metastases from breast carcinoma with radioactive phosphorus alone and in combination with adrenalectomy, John P. Storaasli, Richard L. King, Harvey Krieger, William E. Abbott and Hymer L. Friedell, March, 422  
 —placental transfer of phosphorus in sows maintained on high and low levels of dietary manganese (ab), H. W. Newland et al., March, 526  
 —radioactive isotopes in fractures of neck of femur (ab), G. P. Arden, Jan., 174  
 —radioactive phosphorus in the in vivo diagnosis of melanoma of skin (ab), Earle W. Brauer et al., Feb., 344  
 —solid-state and proportional beta detectors for use in vivo, C. V. Robinson, March, 479  
**radiosilver**  
 —radiophotoluminescent gamma-ray dosimetry of mixed neutron gamma-ray radiation fields, C. G. Amato and S. J. Malsky, Feb., 290. See also correction, May, 830  
**radiostromium**  
 —investigations on strontium-90 content of fodder and milk (ab), Ekkehard Groos, March, 527  
 —strontium studies in beagles (ab), B. W. Glad et al., June, 995  
 —tissue isodose curves for beta surface applicators, Wesley G. McTaggart, Walton D. West, Harry A. Claypool and Vincent P. Collins, Feb., 278  
 —transfer of strontium 90 from mother to fetus in mice (ab), Bo Holberg et al., May, 861  
**radiosulfur**  
 —estradiol reduces incorporation of radioactive sulfate into cartilage and aortas of rats (ab), Robert E. Priest et al., May, 861  
**radioyttrium**  
 —tissue isodose curves for beta surface applicators, Wesley G. McTaggart, Walton D. West, Harry A. Claypool and Vincent P. Collins, Feb., 278  
**radiozinc**  
 —transfer of zinc 65 across the placenta and fetal membranes of rabbit (ab), Carolyn W. Terry et al., Feb., 346  
**RADIOANGIOGRAPHY.** See Radioactivity, radioiodine  
**RADIOAUTOGRAPHY.** See Radioactivity  
**RADIOGRAPHY.** See Radioactivity, radiocobalt; Roentgen Rays, apparatus; Roentgen Rays, diagnosis; under diseases, organs, and regions  
**RADIOLOGICAL SOCIETIES**  
 American Club of Therapeutic Radiologists, Feb., 305  
 Association of Radiologists of Province of Quebec, Feb., 305  
 Canadian Association of Radiologists, March, 486  
 Connecticut Valley Radiologic Society, Jan., 130  
 Dallas-Fort Worth Radiological Society, Feb., 305  
 Greater Miami Radiological Society, April, 649  
 Greater Saint Louis Society of Radiologists, March, 486  
 Houston Radiological Society, March, 486  
 Kansas Radiological Society, April, 649  
 Miami Valley Radiological Society of Dayton, Ohio, March, 486  
 Mississippi Radiological Society, Feb., 305  
 Missouri Radiological Society, June, 978  
 New York Roentgen Society, June, 978  
 North Florida Radiological Society, March, 486  
 Pittsburgh Roentgen Society, Jan., 130  
 Rochester (N. Y.) Roentgen Ray Society, April, 649  
 Rocky Mountain Radiological Society, Midsummer Conference June, 978  
 San Francisco Radiological Society, Jan., 130  
 secretaries and meeting dates, Jan., 134  
 Vermont Radiological Society, June, 978  
 Virginia Radiological Society, March, 486  
 West Virginia Radiological Society, Jan., 130  
 Westchester Radiological Society, June, 978  
**RADIOLOGICAL SOCIETY OF NORTH AMERICA**  
 —silver tray awarded to Dr. Howard P. Doub, Feb., 299  
 forty-sixth annual meeting  
 —Berg, H. Milton, president (ed), Leo G. Rigler, Feb., 296  
 —Carman lecture: historical features of cholecystography, Warren H. Cole, March, 354  
 —(ed), Feb., 298  
 —introduction of Carman lecturer and gold medalist, Theodore J. Wachowski, March, 351  
 —introduction of Memorial Fund lecturer, Leo G. Rigler, April, 531  
 —Memorial Fund lecture: Space radiations: natural and man-made, Payne S. Harris, April, 532  
 —presidential address: some logistics of the Radiological Society of North America, with thoughts about the future (ed), Theodore J. Wachowski, March, 480  
 —scientific exhibits, Feb., 300  
 gold medal  
 —presentation to Dr. Tom Bond, Feb., 299  
 —presentation to Dr. Warren H. Cole, Feb., 299  
**RADIOPHOTOLUMINESCENCE.** See Dosimeters and Dosimetry  
**RADIOThERAPY**  
 See also Cancer, radiotherapy; Radiations, injurious effects; Radioactivity; Radium; Roentgen Therapy; under diseases, organs and regions  
 —calculation of isodoses distributions in interstitial implants by a computer, Robert J. Shalek and Marilyn A. Stovall, Jan., 119  
 —experimental hemopoietic replacement: possible use in radiotherapy (ab), Peter Ilbery, April, 691  
 —“ideal” in vivo dosimetry system for clinical and experimental radiation therapy, B. Roswit, S. J. Malsky, C. G. Amato, C. B. Reid, L. Maddalone and C. Spreckels, Feb., 295  
 —organization of radiotherapeutic service for the (Russian) population (ab), E. I. Vorobiev, March, 523  
 —radiation courses, Queens Hospital Center, New York, May, 830  
**RADIUM**  
 —calculation of isodoses distributions in interstitial implants by a computer, Robert J. Shalek and Marilyn A. Stovall, Jan., 119  
**therapy.** See also Cancer, radiotherapy; Uterus, cancer  
 —afterloading technic with rigid needles in interstitial radiation therapy, Herman D. Suit, Robert J. Shalek, E. B. Moore and J. Robert Andrews, March, 431  
**RAMBACH, WALTER A.** See **ELLIS, JAMES P., Jr.**  
**RAMELLA, G.** See **DOLCE, G.**  
**RAMOS, ALBERTO RAMIREZ, KIRSNER, JOSEPH B., and PALMER, WALTER L.** Peptic ulcer in children: review of literature and report of thirty-two cases (ab), Jan., 153  
**RAO, R. VENKATESWARA**: X-ray diagnosis of hydatid cyst of the lung: its rupture into the bronchus and spontaneous healing (ab), March, 499  
**RAPER, F. P.** See **LAUBSCHER, W. M. L.**  
**RATHE, JOHN C.**: Differential “nephropacification”: a screening procedure for unilateral renal artery occlusion, April, 629  
**RAVENTOS, ANTONIN.** See **LEWIS, GEORGE C., Jr.**  
**RAYMOND, K.** See **HALEY, THOMAS J.**  
**REAVIS, CHARLES W., LONG, THOMAS S., LEMON, WILLIS E., and NICKELL, LAWRENCE R.**: Preparation of the colon with a new senna compound, April, 642  
**REDA, M.** See **AWWAAD, A.**  
**REEVES, JOHN D.** See **WANG, C. C.**  
**REICH, STANLEY B.** See **UHLEY, HERMAN N.**  
**REID, C. B.** See **ROSWIT, B.**  
**RELATIVE BIOLOGICAL EFFECT.** See Betatron; Linear Accelerator; Radioactivity, radiocobalt; Roentgen Rays, effects  
**RENNER, W.**: A new device for skull radiography (ab), Feb., 312  
**RENINNE, A. M.**: The pathology of slipped upper femoral epiphysis. A new concept (ab), March, 514  
**RENOGRAM.** See Kidneys, function tests  
**RESEGOTTI, L.** See **BELLION, B.**  
**RESINS**  
 —ion-exchange  
 —employment of ion-exchange resins for removal of plutonium from gastrointestinal tract (ab), V. A. Belyaev, Feb., 346  
**RESPIRATORY TRACT**  
 See also Bronchi; Lungs; Pharynx; etc.  
 diseases  
 —new form of respiratory disease in premature infants (ab), Miriam G. Wilson and Victor G. Mikity, Feb., 315  
 —radiologic considerations of the perinatal distress syndrome, Edward B. Singleton, Harvey M. Rosenberg and Luis Samper, Feb., 200  
**RETICULOENDOTHELIAL SYSTEM**  
 diseases  
 —primary pulmonary histiocytosis X (ab), Pierre J. Nadeau et al., Jan., 146  
**RETINA**  
 tumors  
 —histopathological study on prognosis and radiosensitivity of retinoblastoma (ab), Isamu Tsukahara, April, 689  
**RETINOBLASTOMA.** See Retina  
**RETROPERITONEUM.** See Abdomen; Emphysema  
**REYNOLDS, R. M., WIETERSEN, F., and REYNOLDS, R. P.**: Intramural diverticulitis (ab), Jan., 156  
**REYNOLDS, R. P.** See **REYNOLDS, R. M.**  
**RHODES, D. H., Jr.** See **LEWIN, J. R.**  
**RICHARDSON, J. FRANCIS.** See **LUND, RONALD R.**  
**RICKETTSIA**  
 —effects of x-rays and beta rays (tritium) on growth of Rickettsia mooseri and Rickettsia akari in embryonate eggs (ab), Donald Greiff et al., April, 702  
**DI RIENZO, NELIDA V.** See **MOSCA, LIDIO G.**  
**RIGLER, LEO G.**: Introduction of the Memorial Fund lecturer: Payne S. Harris, M. D., April, 531  
**RILEY, JAMES R.**: Cholecystography and cholangiography today (ab), Jan., 157  
**RING, EDWARD M.** See **HEMLEY, SAMUEL D.**  
**RITVO, MAX**: The role of diagnostic roentgenology in medicine (ab), April, 659  
**RIVKIN, LAURENCE.** See **UHLEY, HERMAN N.**  
 **RIZZO, V.** See **BOCCACCIO, R.**  
**ROAF, ROBERT**: Vertebral growth and its mechanical control (ab), Jan., 158  
**ROBERTSON, J. I. S.** See **BROWN, J. J.**  
**ROBINSON, C. V.**: Solid-state and proportional beta detectors for use in vivo, March, 479  
**RODMAN, THEODORE, KARR, SAMUEL, and CLOSE, HENRY P.**: Radiation reaction in the lung. Report of a fatal case in a patient with carcinoma of the lung, with studies of pulmonary function before and during prednisone therapy (ab), Feb., 347

**RODS, GLASS** (in dosimetry). See Dosimeters and Dosimetry

**ROENTGEN.** See Cathartics

**ROENTGEN RAYS**  
 See also Body-Section Roentgenography; Cineroentgenography; Radiations; Radiotherapy; Roentgen Therapy apparatus. See also Roentgen Rays, protection against automatic device for voiding urethrogram in infants and small children, J. Scott Dunbar, Richard B. Goldblom, Victor Pollock and Rex Radford, March, 467  
 effectiveness of mass survey of diagnostic x-ray equipment in promoting radiation safety, C. M. Sharp, E. G. Williams and J. R. Knapp, Jan., 121  
 equipment aids in intravenous pyelography, W. C. Smullen, J. W. Little, Jr., and F. A. Winters, March, 475  
 high dose rate x-ray sources with development of light-weight diagnostic unit, W. P. Dyke, Ross Floyd and F. J. Grundhauser, Feb., 257  
 intensifying screens. See Roentgen Rays, fluoroscopy  
 left ventricular and systemic arterial catheterization: simple percutaneous method using a spring guide (ab), Charles T. Dotter, April, 671  
 method of focal spot image formation and measurement, report of Subcommittee IV of International Commission on Radiological Units and Measurements, Jan., 125  
 new device for skull radiography (ab), W. Renner, Feb., 312  
 new method for roentgen examination of fornic and cardial region of stomach (double-contrast examination with spray) (ab), M. Foti, April, 675  
 new stepped wedges for radiography (ab), H. E. Seemann and B. Roth, Jan., 164  
 potassium iodide screens and high-capacity roentgen tubes in angiography (ab), Erik Carlsson, April, 669  
 special axial rotation table for pneumoencephalography, Juan M. Taveras, March, 472  
 stereotaxic apparatus for use in cerebral surgery (ab), A. M. Hasting Bennett, April, 687  
 syringe heater for angiography, Lester L. Vargas and Thomas Forsythe, Feb., 248  
 use of "radiopaque streamers" to show blood currents in heart, T. Dobý, June, 968

**diagnosis.** See also Cineroentgenography; Roentgen Rays, apparatus; Roentgen Rays, injurious effects; under diseases, organs and regions  
 role of diagnostic roentgenology in medicine (ab), Max Ritvo, April, 659  
 technical procedures of radiodiagnostic interest. A symposium. III. Brief summary of industrial radiography and automatic processing (ab), A. J. Weston, April, 686  
 technical procedures of radiodiagnostic interest. A symposium. IV. Methods of multiple radiography (ab), James McInnes, April, 686  
 University of Cincinnati, refresher course in diagnostic roentgenology, April, 649  
 visual search patterns in roentgen diagnosis, William J. Tuddenham and William P. Calvert, Feb., 255

**effects.** See also Radiations, effects; Roentgen Rays, injurious effects  
 acceptance of rat and mouse lung grafts by radiation chimeras (ab), George W. Santos et al., April, 702  
 acute radiation effects in esophagus (ab), F. Lamont Jennings and Anne Arden, April, 698  
 alteration in glucose tolerance produced by irradiation of pelvis (ab), Lilia Lopez Borja et al., Feb., 347  
 autographs of bone marrow in dogs after lethal total-body radiation (ab), John A. Mannick et al., Jan., 178  
 bioelectric activity of mammalian nerves during x-irradiation (ab), C. S. Bachofen and M. E. Gauthereau, June, 998  
 bioelectric responses in situ of mammalian nerves exposed to x-rays (ab), C. S. Bachofen and M. E. Gauthereau, March, 529  
 biologic protection against repeated lethal total-body exposure doses (ab), Hanns Langendorff et al., March, 529  
 changes in cerebral circulation of animal after whole-body ionizing irradiation (ab), R. M. Lyubimova-Gerasimova, Feb., 349  
 changes in membrane potentials, K content, and fiber structure in irradiated frog sartorius muscle (ab), Edgar B. Darden, Jr., March, 529  
 comparative effects of prenatal gamma radiation and x-irradiation on reproductive system of rat (ab), Benjamin H. Ershoff and Ved Brat, March, 530  
 cortisone and irradiation. I. Pulmonary necrosis and blood vessel impairment in irradiated cortisone-treated rat lung (ab), Charles C. Berdjas, April, 698  
 cortisone and irradiation. III. Histopathology of effect of cortisone on irradiated rat kidney (ab), Charles C. Berdjas, April, 699  
 damage and recovery of mouse testis after 1,000 r acute localized x-irradiation, with reference to restitution cells, Sertoli cell increase, and Type A spermatogonial recovery (ab), Bernard R. Nebel and Carol J. Murphy, June, 997  
 delayed hypersensitivity. V. Effect of x-irradiation on the development of delayed hypersensitivity and antibody formation (ab), Jonathan W. Uhr and Matthew Scharff, June, 998  
 do estrogenic and androgenic hormones affect the radiation reaction of tumors? Henry P. Plenk, Fred M. Sorenson and Roger B. Fuson, Feb., 270  
 effect of x-irradiation on DNA metabolism in various tissues of the rat. II. Recovery after sublethal doses of irradiation (ab), Oddvar F. Nygaard and Richard L. Potter, May, 866  
 effect of x-radiation on DNA metabolism in various tissues of the rat. III. Retention of labeled DNA in normal and irradiated animals (ab), Oddvar F. Nygaard and Richard L. Potter, May, 866  
 effects of experimental x-radiation on cornea (ab), Frederick C. Blodi, April, 698  
 effects of x-irradiation on embryos at critical stages of heart development (ab), W. M. Copenhagen et al., April, 699  
 effects of x-rays and beta rays (tritium) on growth of *Rickettsia mooseri* and *Rickettsia akari* in embryonate eggs (ab), Donald Greiff et al., April, 702  
 failure of AET to protect against testes injury in x-irradiated rat (ab), B. H. Ershoff and V. Brat, Feb., 349  
 hypothermia and ischemia of bone marrow as protection against injury by whole-body x-irradiation in rats (ab), Edgar J. Martin, June, 997  
 incidence of mortality and dose-response relationship following partial-body x-irradiation of the rat (ab), A. Dunjic et al., May, 863  
 indirect effect of irradiation on embryonic development. I. Irradiation of mother while shielding the embryonic site (ab), Robert L. Brent and Mary M. McLaughlin, May, 863  
 indirect effect of irradiation on embryonic development. II. Irradiation of placenta (ab), Robert L. Brent, May, 864  
 in vitro leucine incorporation into protein of normal and x-irradiated rabbit bone marrow cells (ab), Edwin M. Uyeki et al., Feb., 349  
 late effects of x-radiation: influence of dose fractionation on life span, leukemia, and nephrosclerosis incidence in mice (ab), L. J. Cole et al., May, 862  
 mutation as a cause of death in offspring of irradiated rats (ab), J. F. McGregor et al., April, 700  
 protective effects on fecundity and fertility from feeding cysteine and glutathione to *Habrobracon* females before x-irradiation (ab), Daniel S. Grosch, May, 866  
 radiation-induced conditioned avoidance behavior in rats, mice, and cats (ab), D. J. Kimeldorf et al., June, 996  
 radiation injury: adrenocortical and gastric responses in the rat (ab), D. G. Baker et al., May, 863  
 reaction of limb regenerates of adult axolotl (*Sirens mexicanum*) to x-irradiation (ab), V. V. Brunt, June, 998  
 red cell repopulation in irradiated mice treated with plethoric homologous bone marrow (ab), Joan W. Goodman and Ray D. Owen, Feb., 349  
 relation of hepatic ketogenesis to radiation-induced decrease in fasting ketonemia (ab), Joseph A. Ontko, Feb., 350  
 relative biological effect of various qualities of x-rays on growth of ascites tumor cells (ab), Norman A. Baily and Ruth A. Brothier, May, 866  
 relative biological effectiveness of cobalt-60 gamma rays and 220-kvp x-rays on viability of chicken eggs (ab), Merle K. Loken et al., May, 865  
 response of kangaroo rat (*Dipodomys merriami Mearns*) to single whole-body x-irradiation (ab), Thomas J. Haley et al., April, 701  
 serum enzymes following whole-body radiation in rabbit (ab), Harry G. Albaum, May, 864  
 shortening of life span of mice by irradiation with x-rays and treatment with radiomimetic chemicals (ab), Peter Alexander and Dorothy I. Connell, April, 700  
 single dosage x-ray radiation to lung and posterior mediastinum through open chest. II. Results in animals receiving a dose of 5,000 r (ab), John J. Fomon et al., Feb., 348  
 some factors which influence radiation-conditioned behavior of rats (ab), John Garcia and Donald J. Kimeldorf, June, 996  
 species differences in altitude tolerance following x-irradiation (ab), Bernard D. Newsom and Donald J. Kimeldorf, March, 529  
 studies on effects of radiation on living cells in tissue culture. I. Radiosensitivity of various imaginal disks and organs in larvae of *Drosophila melanogaster* (ab), Masakatsu Horikawa and Tsutomu Sugahara, May, 865  
 studies on mechanism of secondary disease. The parental-F<sub>1</sub> hybrid radiation chimera (ab), Leonard J. Cole and Richard M. Garver, May, 864  
 studies on radiation-induced mammary gland neoplasia in rat. I. Role of ovary in neoplastic response of breast tissue to total- or partial-body x-irradiation (ab), E. P. Cronkite et al., April, 701  
 studies on radiation-induced mammary gland neoplasia in rat. II. The response of castrate and intact male rats to 400 r of total-body irradiation (ab), C. J. Shellabarger et al., April, 701  
 studies on radiation-induced mammary gland neoplasia in rat. III. Relation of neoplastic response to dose of total-body radiation (ab), V. P. Bond et al., May, 862  
 studies on susceptibility to infection following ionizing radiation. V. Comparison of intraperitoneal and intravenous challenge at intervals following different doses of x-radiation (ab), C. Philip Miller et al., April, 700  
 survival of total-body x-irradiated mice after delayed infusions of isologous bone marrow (ab), Isaac Djerassi et al., June, 997  
 survival time following massive fractionated irradiation (ab), Howard L. Andrews, May, 863  
 x-irradiation lethality aggravated by sexual activity of male mice (ab), Roberts Rugh and Erica Grupp, April, 701

## ROENTGEN RAYS—cont.

films. See also Roentgenograms

- evaluation of film size in cineradiography. John A. Campbell, Eugene C. Klatte, Donald D. Gray and Alice L. McCrea, April, 606
- technical procedures of radiodiagnostic interest. A symposium. III. Brief summary of industrial radiography and automatic processing (ab). A. J. Weston, April, 686
- technical procedures of radiodiagnostic interest. A symposium. IV. Methods of multiple radiography (ab). James McInnes, April, 686

**fluoroscopy.** See also Roentgen Rays, injurious effects; Urinary Tract; etc.

- evaluation of performance of image Orthicon, Vidicon and Permacolor television camera tubes in conjunction with fluoroscopic image intensifiers. Herbert M. Stauffer and George C. Henny, Feb., 269
- large field cineradiography and image intensification utilizing the TVX system. Joseph H. Weiss, Feb., 264
- roentgen television in surgery with special reference to stereo-television (ab). K. Lindblom, April, 687
- spot films. See Cardiovascular System, roentgenography; Cranium, roentgenography
- technical procedures of radiodiagnostic interest. A symposium. I. The fundamental limits of information content in solid state image intensifying panels compared with other intensifying screens (ab). J. F. Fowler, April, 686
- technical procedures of radiodiagnostic interest. A symposium. II. The prospects for solid state intensifying screens (ab). S. T. Henderson, April, 686

**injurious effects.** See also Radiations, injurious effects; Roentgen Rays, protection against

- absorbed dose in thoracic vertebrae in chest roentgenography. R. Wilson and J. A. Carruthers, March, 478
- carcinoma of thyroid gland in childhood: its relation to radiotherapy (ab). Russell Howard, March, 527
- dose to eye from radiographic procedures. Elizabeth F. Focht, George R. Merriam, Jr., Mary Barnes and John A. Evans, March, 459
- effect of repeated fluoroscopic examinations on 1,480 children with a long-term follow-up study (ab). Ann McA. Birch and David H. Baker, March, 528
- effectiveness of mass survey of diagnostic x-ray equipment in promoting radiation safety. C. M. Sharp, E. G. Williams and J. R. Knapp, Jan., 121
- effects of intensive radiation on human heart. Jerome M. Vaeth, Lawrence Z. Feigenbaum and Malcolm D. Merrill, May, 755
- effects of radiations on heart (ab). Arthur Jones and John Wedgwood, Jan., 175
- experimental studies. See Roentgen Rays, effects
- fetal tolerance to radiation; case, Alvaro Ronderos, March, 454
- further observations on late radiation necrosis following therapy of skin cancer. Results of fractionation of the total dose (ab). H. L. Traenkle and Dattatreya Mulay, April, 695
- gonadal dosage in pediatric radiotherapy. John L. Gwinn, David C. Gastineau and John A. Campbell, June, 881
- gonadal exposure incident to roentgen therapy. Gustave Kaplan, Carl Collica and Sidney Rubenfeld, June, 877
- influence of x-ray contact therapy of hemangiomas on growing skeleton (ab). Jaromír Kolář and Václav Bek, April, 695
- initial clinical reaction to therapeutic whole-body roentgen radiation: some civil defense considerations (ab). William C. Levin et al., Jan., 177
- irradiation pneumonitis in treatment of carcinoma of breast (ab). M. N. Lougheed and G. H. Maguire, Feb., 346
- leukemia following x-ray therapy for ankylosing spondylitis (ab). Donald C. Graham, April, 696
- measurement of radiant energy levels in diagnostic roentgenology. Russell H. Morgan, June, 867
- myocardial injury from therapeutic irradiation (ab). Mary Catterall and William Evans, April, 696
- photographic method of measuring fluoroscopic dose to patient. Hanson Blatz and Edward R. Epp, Jan., 120
- radiation hazards in x-ray diagnosis (ab). F. M. Hooper, March, 527
- radiation myelitis (ab). John B. Dynes and Magnus I. Smedal, Jan., 176
- radiation necrosis of ossicles (ab). Joseph Gyorkey and Frederic J. Pollock, March, 527
- radiation reaction in lung; report of fatal case in patient with carcinoma of lung, with studies of pulmonary function before and during prednisone therapy (ab). Theodore Rodman et al., Feb., 347
- role of x-ray therapy to neck region in production of thyroid cancer in young people; 37 cases (ab). E. Hunter Wilson and Samuel P. Asper, Jr., April, 696
- routine cardiac fluoroscopy—an unnecessary health hazard (ab). Eliot Corday and Henry Jaffe, Jan., 176
- thyroid cancer after irradiation in adult life (ab). A. M. Jelliffe and K. M. Jones, June, 995

**physics.** See also Roentgen Therapy

- comparison of theoretical and experimental spectral distributions of scattered x-rays (ab). D. V. Cormack, May, 857
- on the adequacy of half-value layer as a criterion of x-ray quality in calibration of dosimeters (ab). N. M. Procter and J. R. Greening, March, 523

protection against. See also Roentgen Rays, effects

- synchronous field shaping and protection in 2-million-volt rotational therapy. John G. Trump, Kenneth A. Wright, Magnus I. Smedal and Ferdinand A. Salzman, Feb., 275
- universal gonadal shield (ab). Enrique Schwarz et al., June, 995

**stereoscopy.** See Roentgen Rays, fluoroscopy

**technicians.** See Technicians

**ROENTGEN THERAPY**

See also Cancer, radiotherapy; Dosimeters and Dosimetry; Radiotherapy; Roentgen Rays, injurious effects; under diseases, organs and regions

- depth-dose data for rectangular fields. N. Aspin, H. E. Johns and R. J. Horstley, Jan., 76
- method of estimating dose with multiple x-ray beams, the central rays of which are not coplanar, and its application to moving beam therapy (ab). W. E. Livermore, Jan., 170
- multiple implant dosimetry. C. G. Amato, S. J. Malsky, V. P. Bond and B. Roswit, Feb., 292
- practical uses for the radiation polymerization dosimeter in radiation therapy. Frank E. Hoecker, Jan., 116
- high-voltage. See also Bladder, cancer; Ear, cancer; Jaws, cancer; Maxillary Sinus; Testes, tumors; etc.
- advantages of employing mixed high-energy x-ray and electron beams in radiation therapy (ab). Noel H. Gale and G. S. Innes, May, 857
- synchronous field shaping and protection in 2-million-volt rotational therapy. John G. Trump, Kenneth A. Wright, Magnus I. Smedal and Ferdinand A. Salzman, Feb., 275

**ROENTGENGRAMS**

—on the labeling of shadows (ed). E. R. N. Grigg, April, 644

**ROENTGENOLOGY.** See Roentgen Rays, diagnosis

**ROGERS, VINCENT**: Vertebral angiography in the diagnosis of meningioma within the lateral ventricle (ab), March, 493

**ROGOFF, STANLEY M., and DEWEENE, JAMES A.**: Phlebography of the lower extremity (ab), Feb., 320

**RONDEROS, ALVARO**: Fetal tolerance to radiation; a case report, March, 454

**ROQUE, F. T.**: A new face of tuberculosis (ab), June, 986

**ROSE-BENGAL TEST.** See Biliary Tract, cancer; Liver, function tests

**ROSENBERG, COLEMAN H.** See OSCHRAIN, CARL

**ROSENBERG, HARVEY M.** See SINGLETON, EDWARD B.

**ROSENTHALL, LEONARD**: A rapid screening method for  $\text{I}^{131}$  fat-absorption test, Feb., 251

**ROSENZWEIG, MURRAY J.** See FRIEDENBERG, RICHARD M.

**ROSS, J. COSBIE, DAMANSKI, MAREK, and GIBBON, NORMAN**: Urteric reflux in the paraplegic (ab), March, 515

**ROSWIT, B., MALKSY, S. J., AMATO, C. G., REID, C. B., MADDALONE, L., and SPRECKELS, C.**: An "ideal" in vivo dosimetry system for clinical and experimental radiation therapy, Feb., 295

—See AMATO, C. G.

—See SUM, PAUL W.

**ROTA, ALEXANDER N., and FRANSMAN, S. L.**: Dissecting aneurysm of the aorta (ab), Jan., 149

**ROTATIONAL THERAPY.** See Roentgen Therapy

**ROTH, B.** See SEEMANN, H. E.

**ROTH, F., and EGGER, G.**: Report of therapeutic results in carcinoma of the uterus following increased radiation dosage (ab), Jan., 167

**ROTH, H. W., MOVARREKHI, H., and WENGER, P.**: The isotopic renogram. Method, quantitative analysis, and clinical usefulness (ab), Feb., 344

**ROTH, J. L. A.** See KALSER, M. H.

**ROTHWELL, P. G.** See SMITH, W. G.

**ROVNER, DAVID R.** See ALLEN, RALPH G.

**ROZDILSKY, B.** See VULPE, M.

**RUBADEAU, D. O.** See KIMELDORF, D. J.

**RUBEN, H., BENTZEN, N., and SAEV, S. K.**: X-ray study of passage of air through the pharynx in anaesthetised patients (ab), June, 986

**RUBENFELD, SIDNEY.** See KAPLAN, GUSTAVE

—See LENTINO, WALTER

**RUBIN, GUSTAV, and WITTEN, MORRIS**: The talar-tilt angle and the fibular collateral ligaments. A method for the determination of talar tilt (ab), Jan., 161

**RUBIN, PHILIP, and PRABHASAWAT, DUSDEE**: Characteristic bone lesions in post-irradiated carcinoma of the cervix. Metastases versus osteonecrosis, May, 703

**RUBIN, ROBERT J., OSTRUM, BERNARD J., and DEX, WALTER J.**: Water-soluble contrast media: their use in the diagnosis of obstructive gastrointestinal disease (ab), Jan., 152

**RUBINSTEIN, BERTA M.** See FRIEDENBERG, RICHARD M.

**RUDNER, NATHAN.** See TENG, PAUL

**RUFFIN, JULIAN M.** See JANSSEN, BENNO, JR.

**RUGGIERO, GIOVANNI**: A technique for the examination of the optic foramina (ab), Jan., 143

—and SMALTIMO, FRANCESCO: Appearance of the ventricular system 24 hours after encephalography. A preliminary report (ab), Feb., 312

**RUGGLES, R. L.**: Blood loss during adenoectomy and tonsillectomy measured with radioisotopes (ab), April, 694

**RUGH, ROBERTS, and GRUPP, ERICA**: X-irradiation lethality aggravated by sexual activity of male mice (ab), April, 701

—See COPENHAVER, W. M.

RUMBALL, JOHN M. See KAPLAN, ALLAN A.

RUNDLE, F. F. See ODDIE, T. H.

RUSSE, OTTO: Fracture of the carpal navicular. Diagnosis, non-operative treatment, and operative treatment (ab), May, 853

RUSSELL, C. See DALE, W. M.

RUSSIA: —organization of radiotherapeutic service for the (Russian) population (ab), E. I. Vorobiev, March, 523

**S**

SABISTON, DAVID C., Jr. See LANG, ERICH K.

SACHS, MAURICE D., and PARTINGTON, PHILIP F.: The distended gallbladder: the value of a fat meal in cholecystography (ab), March, 509

SÄTERBORG, N.-E.: The technical procedure in kidney examinations with radioactive isotopes (ab), April, 695

SAEV, S. K. See RUBEN, H.

SAGHATOLESIANI, MEHDI. See NORMAN, ALEX

SALERNO, PAUL R. See UYEKI, EDWIN M.

SALIVARY GLANDS: —ialography and surface anatomy of parotid duct (ab), H. Oppenheim and M. Wing, March, 495

SALMONELLA: —Salmonella osteitis in Nigerian children (ab), R. G. Hendricks and Patrick Collard, May, 851

SALT: See Sodium chloride

SALTZMAN, GEORG-FREDRIK. See HÖÖK, OLLE

SALZMAN, FERDINAND A. See TRUMP, JOHN G.

SAMPER, LUIS. See SINGLETON, EDWARD B.

SAMUEL, ERIC: The use of contrast medium in the investigation of the acute abdomen (ab), April, 674

—See PYLE, ROGER

SANDBERG, HERSCHEL, MIN, BYONG SOK, FEINBERG, LEONARD, and BELLET, SAMUEL:  $^{131}\text{I}$  triolein tolerance curves in patients with diabetes mellitus. Their similarity to those observed in myocardial infarction (ab), April, 693

SANDER, O. A.: Current concepts of pneumoconioses—clinical aspects (ab), Feb., 315

SANDERSON, M. H. See STEARNER, S. P.

SANDERSON, STEVENS S., and GROSS, KENNETH E.: Cinecholedochography, Feb., 267

SANTESSON, BERTA. See BÖK, J. A.

SANTOS, GEORGE W., GARVER, RICHARD M., and COLE, LEONARD J.: Acceptance of rat and mouse lung grafts by radiation chimeras (ab), April, 702

SARCOIDOSIS: —middle-lobe atelectasis due to endobronchial sarcoidosis, with hypercalcemia and renal impairment (ab), Gerald J. Goldenberg and Richard H. Greenspan, April, 662

—sarcoidosis: experience at a naval hospital (ab), C. Charles Welch and Robert O. Canada, March, 498

SARCOMA: See also under organs and regions

liposarcoma: —pathology, diagnosis and treatment of liposarcoma (ab), Heinrich Schäfer, April, 688

lymphosarcoma: —primary lymphosarcoma (reticulos-cell) of stomach; case (ab), Gerald A. Erhard et al., Feb., 338

myosarcoma: —leiomyosarcoma of duodenum; collective review (ab), T. E. Starzl et al., Feb., 322

SARGENT, JAMES W.: Ureretal metastasis from renal adenocarcinoma presenting a bizarre urogram (ab), Jan., 163

SASSON, LEON: Entrance of barium into intestinal glands during barium enema (ab), March, 507

SAVAGE, PAUL T.: The management of acute intestinal obstruction. A critical review of 179 personal cases (ab), March, 507

SAVARA, BHIM S. See HINCK, VINCENT C.

SAYEGH, VICTOR. See FRIEDENBERG, RICHARD M.

—See ZIMMERMAN, CHARLES

SAYLOR, MARK L. See SMITH, JOHN P.

SCADDING, J. G.: Chronic diffuse interstitial fibrosis of the lungs (ab), Jan., 145

SCANNING SYSTEM. See Counters and Counting

SCAPHOID BONE, CARPAL: —fracture of carpal navicular: diagnosis, nonoperative treatment, and operative treatment (ab), Otto Russe, May, 853

SCAPULA: —rare "os supraceracoideum" (ab), G. Lisch, April, 682

SCARS: —radiation in management of keloids and hypertrophic scars (ab), H. A. S. Van den Breuk and C. C. J. Minty, March, 517

—thyroid cancer after irradiation (for keloid and burn scars) in adult life (ab), A. M. Jelliffe and K. M. Jones, June, 995

SCHÄFER, HEINRICH: Pathology, diagnosis and treatment of liposarcoma (ab), April, 662

SCHAFFER, BURTON. See WALLACE, SIDNEY

SCHARFF, MATTHEW. See UHR, JONATHAN W.

SCHIFF, LEON. See ZEID, SHERWIN S.

SCHIFFINO, A. See di GUGLIELMO, L.

SCHILDECKER, WILLIAM. See FAVIS, EDWARD A.

SCHMERMUND, HANS-JOACHIM. See SCHUBERT, GERHARD

SCHNEIDER, MARTIN. See LEVIN, WILLIAM C.

SCHÖNBAUM, E. See BAKER, D. G.

SCHRÖDER, W.: Objective diagnostic routine for pulmonary emphysema (ab), March, 500

SCHTEINGART, DAVID E., PERLMUTTER, MARTIN, and NUMEROFF, MARVIN: Effect of diuretics upon the serum protein bound iodine and the thyroidal uptake of radioactive iodine (ab), June, 994

SCHUBERT, GERHARD, SCHMERMUND, HANS-JOACHIM, and OBERHEUSER, FRIEDHELM: Beta-tron therapy of gynecologic cancers (ab), March, 520

—See OBERHEUSER, FRIEDHELM

SCHUCHARDT, KARL. See OBERHEUSER, FRIEDHELM

SCHÜLLER, EDMUND. See KRATOCHWIL, ALFRED

SCHULTZE, GUNTER. See BAGHDASSARIAN, OLGA M.

SCHULZ, EMIL. See HILBISH, THEODORE F.

SCHULZ, R. J., COHEN, G. A., TSAI, J. P., and EVANS, J. C.: Cobalt-60 depth-dose corrections as determined by transmission dose measurements, Jan., 117; May, 805

—See FRIEDENBERG, RICHARD M.

SCHWARTZ, A., PFAU, A., and WEINBERG, H.: Association of calyceal diverticulum and butterfly vertebra (ab), May, 855

SCHWARZ, ENRIQUE: Diagnostic value of radiography in volvulus of the colon (ab), March, 508

—PRETTO, JOHN I., and MARTIN, SAMUEL: A universal gonadal shield (ab), June, 995

SCINTILLATION COUNTER. See Counters and Counting

SCLEROSIS: See also Arteriosclerosis; Nephrosclerosis; Osteosclerosis

tuberous: —tuberous sclerosis complex; unusual case of adenoma sebaceum, tuberous sclerosis, and extensive bone lesions (ab), Junji Hasegawa and Royal E. Burke, March, 512

SCOLIOSIS: See Spine, curvature

SCOTT, H. WILLIAM, JR. See FOSTER, JOHN H.

SCOTT, RALPH M.: Time-dose relationship in Hodgkin's disease, Feb., 276

SCREENS. See Roentgen Rays, apparatus

SCUDAMORE, HAROLD H. See THOENY, ROBERT H.

SCURSATONE, M. See MACARINI, N.

SEALY, ROSSALL, and KRIGE, H.: An oesophageal tumour: report of a case (ab), Jan., 152

SEAR, R. See COHEN, M.

SEBACEOUS GLANDS: —tuberous sclerosis complex: unusual case of adenoma sebaceum, tuberous sclerosis, and extensive bone lesions (ab), Junji Hasegawa and Royal E. Burke, March, 512

SECERGAN: —effect of Secergan on duodenum and common bile duct (ab), Paul Edholm, March, 511

SECOND CONFERENCE ON MICRodosimetry, Feb., 305

SECREST, P. G., and KENDIG, TOM A.: Medullary sponge kidney: roentgen diagnosis of three cases, June, 920

SEEMANN, D. See HAWLICZEK, F.

SEEMANN, H. E., and ROTH, B.: New stepped wedges for radiography (ab), Jan., 164

SEGAL, ROBERT L. See ELLER, MILTON

SEITCHIK, MURRAY W., POLL, MARVIN, KOMRAD, EUGENE L., and BARONOFSKY, IVAN D.: Studies in visceral arteriography (ab), June, 987

SELLA TURICA: —width (third dimension) of sella turica (ab), Giovanni Di Chiro, June, 983

SEMENOV, L. F.: The testing of indoleamine compounds in the prevention of radiation illness (ab), March, 530

SEMINOMA. See Tumors, seminoma

SENNA. See Cathartics

SENSITIZATION RESPONSE. See Uterus, cancer

SENTURIA, HYMAN R. See SUSMAN, NOAH

SENZ, EDWARD. See ALLANSMITH, MATHEA

SEROTONIN: —biologic protection against repeated lethal total-body exposure doses (ab), Hanns Langendorff et al., March, 529

—testing of indoleamine compounds in prevention of radiation illness (ab), L. F. Semenov, March, 530

SERRATRICE, G. See LEGRÉ, J.

SERTOLI CELLS. See Testes

SEVELIUS, GUNNAR. See JOHNSON, PHILIP C.

SEX: —x-irradiation lethality aggravated by sexual activity of male mice (ab), Roberts Rugh and Erica Grapp, April, 701

SGALINER, M.: Roentgen diagnosis of destructive syphilis of the spine (ab), May, 851

SHALEK, ROBERT J., and STOVAL, MARILYN A.: The calculation of isodose distributions in interstitial implantations by a computer, Jan., 119

—See SUIT, HERMAN D.

SHAPIRO, JEROME H., OCH, MICHAEL, and JACOBSON, HAROLD G.: Differential diagnosis of intradural (extramedullary) and extradural spinal canal tumors, May, 718

—See FRIEDENBERG, RICHARD M.

—See HAIMOVICI, HENRY

SHARP, C. M., WILLIAMS, E. G., and KNAPP, J. R.: Effectiveness of mass survey of diagnostic x-ray equipment in promoting radiation safety, Jan., 121

SHAYER, WARD: Accuracy of routine gallbladder and biliary duct studies (ab), March, 509

SHAW, D. A. See BULL, J. W. D.

**SHEA, JAMES J.** See DOUB, HOWARD P.

**SHEEHAN, R., HRESHCHYSHYN, M., LIN, R. K., and LESSMANN, F. P.**: The use of lymphography as a diagnostic method, Jan., 47

**SHEHADI, WILLIAM H.**: Experiences with Duograin (ab), Feb., 336

**SHELINE, GLENN E., GOLDBERG, MINNIE B., and FELDMAN, ROBERT**: Pituitary irradiation for acromegaly, Jan., 70

—See BOND, V. P.

—See CRONKITE, E. P.

**SHERMAN, ALFRED I.** See HOLTZ, SUMNER

**SHERMAN, F. G.** See CATTANEO, S. M.

**SHERMAN, ROGER T.** See HARDY, RICHARD W.

**SHIELDING**: See Radioactivity, radioisotopes; Roentgen Rays, protection against

**SHILL, O. S.** See ALPEN, E. L.

**SHINER, MARGOT**: See DONIACH, I.

**SHLANSKY, ELLIOTT**: See TUMEN, HENRY J.

**SHOPFNER, CHARLES E., and ALLEN, R. PARKER**: Lymphangioma of bone, March, 449

**SIALOGRAPHY**: See Salivary Glands

**SIEGELAUB, A. B. A.** See FRIEDENBERG, RICHARD M.

**SIGMOID**

- differential diagnosis of carcinoma of sigmoid and diverticulitis: evaluation of aids (ab), Joseph L. Ponka et al, Jan., 156
- diverticula
- differential diagnosis of carcinoma of sigmoid and diverticulitis: evaluation of aids (ab), Joseph L. Ponka et al, Jan., 156

**SILVER**

- comparison of two fluorometers designed to measure radiation-induced fluorescence of silver-activated glass rods, Nathaniel F. Barr, Mary Stark and J. S. Laughlin, Jan., 113
- multiple implant dosimetry, C. G. Amato, S. J. Malsky, V. P. Bond and B. Roswit, Feb., 292
- radioactive. See Radioactivity, radiosiliver

**SILVER, IAN A.** See CATER, DONALD B.

**SILVER, SOLOMON**: See ELLER, MILTON

**SINCLAIR, T. C.** See WHEATLEY, B. M.

**SINGER, LEON**: See CARLSON, CURTIS H.

**SINGLETON, EDWARD B., ROSENBERG, HARVEY M., and SAMPER, LUIS**: Radiologic considerations of the perinatal distress syndrome, Feb., 200

**SINKLER, WILLIAM H., and SPENCER, ANDREW D.**: The value of peripheral arteriography in assessing acute vascular injuries (ab), Jan., 150

**SINUS TRACTS**

- occipital dermal sinus: clinical and radiological findings when a complete occipital dermal sinus is associated with a dermoid cyst (ab), George F. Smith and Donald H. Altman, Jan., 142

**SINUSES, PARASINAL**

- See also Maxillary Sinus
- roentgen diagnosis of paranasal sinuses, Sölve Welin, March, 494

**SKIN**

- cancer
- further observations on late radiation necrosis following therapy of skin cancer. Results of fractionation of the total dose (ab), H. L. Traenkle and Dattatreya Mulay, April, 695
- private dermatologist and skin cancer: clinical study of 226 epitheliomas derived from five dermatologic practices (ab), Richard J. Ferrara, Feb., 337
- roentgen therapy of skin and lip carcinoma: factors influencing success and failure (ab), Carl F. von Essen, Jan., 165
- tumors
- radioactive phosphorus in the in vivo diagnosis of melanoma of skin (ab), Earle W. Brauer et al, Feb., 344

**SKULL**: See Cranium

**SLATER, STANLEY, PERLMUTTER, MARTIN, PAZ-CARRANZA, JULIO, and NUMEROFF, MARVIN**: The effects of several thyroxine analogues upon the thyroidal  $I^{131}$  uptake in man (ab), Feb., 342

**SLINGERLAND, D. WARD**: See YAMAZAKI, E.

**SLOAN, HERBERT E.** See HOOD, R. MAURICE

**SLOAN, ROBERT D., BROCK, JOSEPH W., and FANT, WILLIAM M.**: Non-strangulating distal ileal obstruction. Part I: The role of hydration. An experimental study correlating pathologic and radiologic findings, March, 407

**SMALTINO, FRANCESCO**: See RUGGIERO, GIOVANNI

**SMEDAL, MAGNUS I., and EVANS, JAMES A.**: The cause and treatment of edema of the arm following radical mastectomy (ab), May, 856

—See DYNES, JOHN B.

—and MEISSNER, WILLIAM A.: Results of x-ray treatment in undifferentiated carcinoma of thyroid, June, 927

—See TRUMP, JOHN G.

**SMIDDY, F. G., and ANDERSON, G. K.**: Tolerance of the kidneys to the contrast medium Urograffin (ab), June, 990

**SMITH, GEORGE F., and ALTMAN, DONALD H.**: Occipital dermal sinus: clinical and radiological findings when a complete occipital dermal sinus is associated with a dermoid cyst (ab), Jan., 142

**SMITH, JOHN P., and SAYLOR, MARK L.**: Renal vascular hypertension in children (ab), May, 846

**SMITH, RALPH C.** See STORER, JOHN

**SMITH, RICHARD L.** See ALTMAN, DONALD H.

**SMITH, RICHMOND W., Jr., EYLER, WILLIAM R., and MELLINGER, RAYMOND C.**: On the incidence of senile osteoporosis (ab), April, 681

**SMITH, W. G., DAVIES, E. R., LODWIG, G. S., ROTHWELL, P. G., and MAHONEY, M. P.**: Bronchography: a neglected investigation? (ab), May, 842

**SMULLEN, W. C., LITTLE, J. W., Jr., and WINTERS, F. A.**: Equipment aids in intravenous pyelography, March, 473

**SNOWMAN HEART**: See Veins, pulmonary

**SOCIETY OF NUCLEAR MEDICINE**, Pittsburgh Chapter, June, 978; Southwestern Chapter, March, 486

**SODIUM chloride**

- effect of salt feeding on thyroid metabolism of  $I^{131}$  in dog (ab), Joseph B. Boatman et al, April, 693
- iodinamide. See Iodine Ducts, roentgenography

**SOFFER, L. J.** See IANNACCONE, A.

**SOLOFF, LOUIS A.** See STAUFFER, HERBERT M.

**SOLOMONS, EDWARD, LEVIN, EMANUEL J., BAUMAN, JUDAH, and BARON, JOEL**: A pyelographic study of ureteric injuries sustained during hysterectomy for benign conditions (ab), May, 855

**SOLOVAY, JULIUS, and BRICE, GRATIEN B.**: Laminography in the follow-up of fractures of the odontoid process (ab), Feb., 313

**SORENSEN, FRED M.** See PLENK, HENRY P.

**SORS, CH.** See EVEN, R.

**SOULE, A. BRADLEY**: See FORRESTER, HENRY C.

**SPACE**

- medical aspects of ambient radiations of extraterrestrial space (ab), Paul A. Campbell, Jan., 178
- space radiations: natural and man-made; Memorial Fund lecture, Payne S. Harris, April, 532

**SPEARS, J. R.** See FOUCHE, R. F.

**SPECIES**

- species differences in altitude tolerance following x-irradiation (ab), Bernard D. Newsom and Donald J. Kimeldorf, March, 529

**SPECTRUM**

- comparison of theoretical and experimental spectral distributions of scattered x-rays (ab), D. V. Cormack, May, 857

**SPENCER, ANDREW D.** See SINKLER, WILLIAM H.

**SPERMATOZOA**

- damage and recovery of mouse testis after 1,000 r acute localized x-irradiation, with reference to restitution cells, Sertoli cell increase, and Type A spermatogonial recovery (ab), Bernard R. Nebel and Carol J. Murphy, June, 997

**SPHENOID BONE**

- pheochromocytoma with large cystic calcification and associated sphenoid ridge malformation, John H. Feist and Elliott C. Lasser, Jan., 21

**SPIERS, F. W.** See COURT BROWN, W. M.

**SPIESSL, BERNHARD**: See OBERHEUSER, FRIEDEM

**SPINAL CANAL ROENTGENOGRAPHY**

- See also Spine, intervertebral disks
- importance of cervical myelography in cervical and upper thoracic nerve root avulsion, William J. Varley, March, 376

**SPINAL CORD**

- See also Meninges
- blood supply
- circulation of spinal cord studied by autoradiography (ab), Eiichi Otomo et al, Jan., 174
- compression
- spondylosis of cervical spine with compression of spinal cord and nerve roots (ab), Paul Teng, Feb., 330
- inflammation. See Myelitis
- tumors
- spinal cord tumors, G. Lombardi and A. Passerini, March, 381

**SPINE**

- See also Atlas and Axis; Spinal Cord
- absorbed dose in thoracic vertebrae in chest roentgenography, R. Wilson and J. A. Carruthers, March, 478
- vertebral growth and its mechanical control (ab), Robert Roaf, Jan., 158
- abnormalities
- association of calyceal diverticulum and butterfly vertebra (ab), A. Schwartz et al, May, 855
- dysphagia and hypertrophic spurring of cervical spine (ab), David A. Hilding and Mihran O. Tachdjian, May, 852
- significance of abnormalities of cervical spine (ab), Donald L. McRae, June, 985
- ankylosis; arthritis
- leukemia following x-ray therapy for ankylosing spondylitis (ab), Donald C. Graham, April, 696
- curvature
- scoliosis: diagnosis and natural history (ab), W. T. Mustard, March, 513
- diseases. See also Spine, osteomyelitis
- actinomycosis with involvement of vertebral column; case report and review of literature (ab), W. B. Young, May, 852

SPINE, diseases—*cont.*

- spondylosis of cervical spine with compression of spinal cord and nerve roots (ab), Paul Teng, Feb., 330
- fractures
- classification of cervical spine injuries (ab), Joseph E. Whitley and H. Francis Forsyth, Feb., 330
- intervertebral disks
- calcified cervical disks in a child (ab), Frank T. Pierce, Jr., and William Hanacee, Feb., 331
- correlation of myelogram with clinical and operative findings in lumbar disk lesions (ab), W. Edward Lansche and Lee T. Ford, Jan., 159
- discography: technic and interpretation (ab), Charles Keck, Feb., 332
- discovertebral necrosis after aortography (ab), M. Demoulin, March, 502
- evaluation of vertebral venography (ab), M. H. Nathan and Luis Blum, April, 671
- extradural osseous lesions simulating the disk syndrome (ab), Harry R. Walker, Jan., 160
- intervertebral disk protrusions in childhood and adolescence (ab), John E. A. O'Connell, March, 513
- posterior migration of a herniated disk, Laible A. Kessler and Wilhelm Z. Stern, Jan., 104
- osteomyelitis
- acute pyogenic infections of spine in children (ab), A. E. Prritchard and W. A. L. Thompson, Jan., 159
- osteomyelitis of spine, Yoeh Ming Ting, Jan., 27
- physiology
- backache from lumbosacral instability (ab), Maurice H. Herzmark, Feb., 331
- roentgenography. See also other subheads under Spine
- low back disorders: value of radiographs of dorsal vertebrae in evaluating etiology of lumbosacral derangements (ab), C. J. Sutro et al., Feb., 331

## syphilis

- roentgen diagnosis of destructive syphilis of spine (ab), M. Sgallit, May, 851
- tumors
- differential diagnosis of intradural (extramedullary) and extradural spinal canal tumors, Jerome H. Shapiro, Michael Och and Harold G. Jacobson, May, 718
- evaluation of vertebral venography (in detection of vertebral metastases) (ab), M. H. Nathan and Luis Blum, April, 671
- extradural osseous lesions simulating the disk syndrome (ab), Harry R. Walker, Jan., 160
- radiologic aspects of primary tumors of spine and their treatment, 40 cases (ab), J. Legré and G. Serraticre, March, 520

## SPIRO, HOWARD M. See NAGLER, RICHARD

## SPLEEN

- effect of homologous bone marrow-spleen cell suspension on survival of swine exposed to radiation from a nuclear weapon (ab), Harry W. Daniell and William H. Crosby, April, 702
- supradiaphragmatic transposition of the spleen for portal hypertension: an experimental and clinical study (ab), Henry L. Hoffman and Samuel O. Freedlander, Jan., 151
- technical considerations in scintillation scanning of human spleen, Philip M. Johnson and John C. Herion, March, 438

## hypertrophy

- use of  $^{35}\text{Cr}$  labeled red blood cells in study of splenomegaly and sites of hemocathesis (ab), A. Fieschi et al., May, 859
- puncture. See Portal Vein, roentgenography

## SPLENOPORTAL VENOGRAPHY. See Portal Vein

## SPONDYLITIS. See Spine, ankylosis; arthritis

## SPONDYLOSIS. See Spine, diseases

## SPONGE KIDNEY. See Kidneys, cysts

## SPOT-FLIMES. See Cardiovascular System, roentgenography; Cranium, roentgenography

## SPRAY DEVICE. See Roentgen Rays, apparatus

## SPRECKELS, C. See ROSWIT, B.

## SPRING GUIDE. See Heart, catheterization

## SPRUE

- See also Malabsorption Syndrome; Steatorrhea
- clinical behavior of sprue in the United States (ab), Paul A. Green and Eric E. Wollaeger, Feb., 324

## STALEY, CHARLES J.: Retrograde ileopyelography (ab), June, 990

## STANDARD, K. L. See MONTGOMERY, R. D.

## STARK, MARY. See BARR, NATHANIEL F.

## STARR, ALBERT, MENASHE, VICTOR, and DOTTER, CHARLES T.: Surgical correction of aortic insufficiency associated with ventricular septal defect (ab), May, 843

## STARZL, T. E., BERNHARD, VICTOR M., and HENEGAR, GEORGE C.: Collective review: leiomyosarcoma of the duodenum (ab), Feb., 322

## STATISTICS

- See also Cancer, therapy
- statistics and the physician (ed), Christian V. Cimmino, Jan., 128. See also letter to editor, R. R. Newell, May, 831

## STATTIN, STURE: Percutaneous lumen-portal venography in the demonstration of liver masses (ab), Feb., 326

## STAUFFER, HERBERT M., BONAKDAR-POUR, AKBAR, and WOLOSHIN, HENRY J.: Brief massive spasm of distal esophagus greatly increasing gastric herniation, documented cineradiographically in a patient with lower esophageal ring (ab), Feb., 320

## —and HENRY, GEORGE C.: Evaluation of performance of image Orthicon, Vidicon and Permachrom television camera

tubes in conjunction with fluoroscopic image intensifiers, Feb., 289

- SOLOFF, LOUIS A., ZATUCHNI, JACOB, and CARTER, BARBARA L.: Gas and opaque contrast in roentgenographic diagnosis of pericardial disease (ab), Jan., 148
- STEARNER, S. P., SANDERSON, M. H., CHRISTIAN, E. J., and TYLER, S. A.: Modes of radiation death in the chick embryo. I. Acute syndromes (ab), May, 865

—See TYLER, S. A.

## STEATORRHEA

- See also Malabsorption Syndrome
- effect of corticosteroids and gluten-free diet on absorption of iron in idiopathic steatorrhea and celiac disease (ab), John Badenoch and Sheila T. Calleender, June, 994
- labeled fat and pancreatic as a differential absorption test in patients with steatorrhea (ab), Abraham A. Polachek and Robert F. Willard, April, 693

STECKEN, A. See HOLSTEIN, J.

STEICHEN, FELICIAN M. See WILDER, ROBERT J.

STEIN, GEORGE N. See FINKELSTEIN, LEAH SHORE

—See TUMEN, HENRY J.

STEINBACH, HOWARD L.: Identification of pelvic masses by phlebothorax displacement (ab), April, 673

STEINBERG, ISRAEL: Lipoid pneumonia associated with paraesophageal hernia: angiographic study of a case (ab), Jan., 145

Localization of bullets and metallic fragments in the cardiovascular system: role of angiography in 7 cases (ab), April, 664

—FINBY, NATHANIEL, and EVANS, JOHN A.: Ditriokon: a new cardiovascular contrast agent, Jan., 96

ŠTĚPÁNEK, V., and DOLEČEK, R.: Skeletal changes in burned patients (ab), April, 682

STERN, WILHELM Z. See KESSLER, LAIBE A.

## STERNUM

—percussion of sternum. I. Aid to differentiation of pericardial effusion and cardiac dilatation (ab), William Dressler, April, 666

## STEROIDS. See Adrenocortical Preparations

STEVENSON, JOHN K., and NYHUS, LLOYD M.: A clinical aid in operative cholangiography (ab), April, 681

STEWART, CHARLES MONTGOMERY: Congenital bladder neck obstruction: diagnosis by delayed and voiding cystography and surgical removal by use of a new cold, crush-cutting punch (ab), March, 516

STEWART, J. G.: Some clinical aspects of megavoltage. A wedge filter approach with 4 MV radiation to the treatment of carcinoma of the alveolus and antrum (ab), Feb., 340

STEWART, W. K. See WALKER, W. F.

STOLL, B. A. See ACKLAND, T. H.

## STOMACH

See also Digestive System: Gastrointestinal Tract

## abnormalities

—duplication of stomach; case, R. John Gould and Allan H. Toffler, May, 790

acidity. See Stomach, effects of irradiation

calcification. See Stomach, cancer

—accuracy of roentgen diagnosis in carcinoma of stomach (ab), John R. Amber, Feb., 321

—adenocarcinoma of stomach with calcification; case (ab), G. O. McGinnis, May, 847

—calcifying mucous-cell carcinoma of stomach; case (ab), Mansho T. Khilnani, March, 506

—carcinoma of stomach: evaluation of diagnostic methods including exfoliative cytology (ab), W. Burnett et al., Feb., 321

—gastric stump carcinoma (ab), D. Vajda et al., April, 676

—malignant disease and gastric polyps (ab), Leonard Breslaw, April, 676

—roentgenographic findings in early case of linitis plastica (ab), Franz J. Lust and Henry J. Heimlich, March, 506

—roentgenologic diagnosis of gastrocolic and gastrojejunocolic fistulas (following surgical treatment of cancer and peptic ulcer) (ab), Robert H. Thoeny et al., April, 677

## dilatation

—acute gastric dilatation (ab), Ted F. Leigh, Jan., 152

## diseases

—gastric retention during oral cholecystography due to underlying lesions of stomach and duodenum (ab), P. Ruben Kochler et al., Feb., 323

## effects of irradiation

—effect of roentgen therapy upon gastric acidity: clinical and experimental studies (ab), James V. McCullough, Jan., 176

—radiation injury: adrenocortical and gastric responses in rat (ab), D. G. Baker et al., May, 863

—See Fistula

## gangrene

—strangulated diaphragmatic hernia complicated by gangrene of stomach (ab), Lawrence Braslow et al., Feb., 322

—brief massive spasm of distal esophagus greatly increasing gastric herniation, documented cineradiographically in patient with lower esophageal ring (ab), Herbert M. Stauffer et al., Feb., 320

—traumatic transthoracic diaphragmatic herniation of stomach (ab), Theodore E. Keats, March, 505

—gastric retention during oral cholecystography due to underlying lesions of stomach and duodenum (ab), P. Ruben Kochler et al., Feb., 323

**STOMACH, motility**—*cont.*  
 —motility changes revealing esophagogastric junction, Majic S. Potsaid, Goro Irie and Nathan T. Griscom, Feb., 262  
**mucosa**  
 —malabsorption syndromes: a symposium, V. Histopathology of stomach in pernicious anemia and jejunum in steatorrhea (ab), I. Doniach and Margot Shiner, April, 679  
**physiology**  
 —some factors which influence radiation-conditioned behavior of rats (ab), John Garcia and Donald J. Kimeldorf, June, 996  
**regurgitation**  
 —effect of gastric intubation on normal mechanisms preventing gastroesophageal reflux (ab), Richard Nagler et al., April, 675  
**roentgenography**. See also other subheads under Stomach  
 —malabsorption syndromes: a symposium, IV. Radiological features of pernicious anemia (ab), J. W. Laws and R. G. Pitman, April, 679  
 —new method for roentgen examination of fornix and cardial region of stomach (double-contrast examination with spray) (ab), M. Föti, April, 675  
**surgery**. See also Fistula, gastrocolic; Peptic Ulcer, surgical therapy; Stomach, cancer  
 —method of roentgenologic functional evaluation of operated stomach (ab), W. Hiemisch, Feb., 322  
 —radiological appearances in postgastrectomy dumping syndrome (ab), H. L. Duthie and N. J. McKellar, Jan., 154  
**tumors**  
 —diagnosis and results of treatment in gastric polyps (ab), Edward G. Huppert et al., Jan., 154  
 —malignant disease and gastric polyps (ab), Leonard Breslaw, April, 676  
 —primary lymphosarcoma (reticulosarcoma) of stomach; case (ab), Gerald A. Erhard et al., Feb., 338  
**ulcers**. See Peptic Ulcer  
**volvulus**  
 —chronic gastric volvulus: symptoms of epigastric pain and emesis (ab), Creighton A. Hardin and Colvin H. Agnew, Feb., 321  
**STONE, ROBERT S.**: Factors influencing maximum permissible doses of radiations. Gordon Richards Memorial Lecture (ab), May, 862  
 —See BENCOSME, SERGIO A.  
**STORAASLI, JOHN P.**, **KING, RICHARD L.**, **KRIEGER, HARVEY**, **ABBOTT, WILLIAM E.**, and **FRIEDELL, HYMER L.**: Palliation of osseous metastases from breast carcinoma with radioactive phosphorus alone and in combination with adrenalectomy, March, 422  
 —See KAZMIN, MARVIN  
**STORER, JOHN**, and **SMITH, RALPH C.**: The calcified hilar node: its significance and management. A review (ab), April, 663  
**STORM, O.**. See BRÜNNER, S.  
**STOVAL, MARYLYN A.**. See SHALEK, ROBERT J.  
**STRAFFON, RALPH A.**, and **GARCIA, ANTONIO M.**: A clinical evaluation of the radioactive Diodrast renogram as a screening test in hypertension (ab), March, 524  
**STRESS**  
 —effects of certain physical and emotional tensions and strains on fluctuations in level of serum protein-bound iodine (ab), Robert Voipé et al., Feb., 342  
**fractures**. See Patella  
**STROKE**. See Brain, blood supply  
**STRONTIUM**. See Radioactivity, radiostrontium  
**STUART, CHARLES**: Perforated peptic ulcer. Radiological review of 50 consecutive cases (ab), April, 676  
**STUDENSKI, E. R.**. See NAZARENO, J. P.  
**STURTEVANT, H. N.**. See EWART, J. A.  
**SUBARACHNOID SPACE**. See Meninges  
**SUGAHARA, TSUTOMU**, **MASAKATSU SUIT**, **HERMAN D.**, **SHALEK, ROBERT J.**, **MOORE, E. B.**, and **ANDREWS, J. ROBERT**: Afterloading technic with rigid needles in interstitial radiation therapy, March, 431  
**SULFUR**. See Radioactivity, radiosulfur  
**SULLIVAN, B. H., Jr.**. See EWART, J. A.  
**SUM, PAUL W.**, **ROSWIT, BERNARD**, and **UNGER, SOL M.**: Skeletal metastases from malignant testicular tumors. A report of 10 cases with osteolytic and osteoblastic changes (ab), Feb., 329  
**SURGERY**  
 See also Heart, abnormalities; Lungs, cancer; Stomach, surgery; Tonsils, etc.  
 —roentgen television in surgery with special reference to stereo-television (ab), K. Lindblom, April, 687  
**SUSMAN, NOAH**, and **SENTURIA, HYMAN R.**: Gas embolization of the portal venous system (ab), March, 505  
**SUTRO, C. J.**, **EHRLICH, D. E.**, and **WITTEN, M.**: Low back disorders. Value of radiographs of the dorsal vertebrae in evaluating the etiology of lumbosacral derangements (ab), Feb., 331  
**SUTTON, DAVID**: Arteriography in the diagnosis of dissecting aneurysm (ab), March, 503  
 —See BROWN, J. J.  
**SWARTZ, DONALD P.**. See HEAGY, FRED C.  
**SWEETNAM, D. R.**, **MASON, R. M.**, and **MURRAY, R. O.**: Steroid arthropathy of the hip (ab), March, 514  
**SYNOVIA**  
 —roentgen manifestations of synovial osteochondromatosis (ab), Charles Zimmerman and Victor Sayegh, Feb., 329  
**SYPHILIS**. See Spine, syphilis  
**SYRINGE HEATER**  
 —syringe heater for angiography, Lester L. Vargas and Thomas Forsythe, Feb., 248  
**SZUR, L.**. See LEWIS, S. M.

**T**

**TACHDJIAN, MIHRAN O.**. See HILDING, DAVID A.  
**TALUS**. See Ankle  
**TANNENHAUS, JOSEPH**. See CULVER, GORDON J.  
**TASTE**

—radiation-induced conditioned avoidance behavior in rats, mice, and cats (ab), D. J. Kimeldorf et al., June, 996

**TATSCHE, R. E.**. See LOGIE, D. C.

**TAUSSIG-BING HEART**. See Heart, abnormalities

—incisural space occupying lesions (ab), May, 838

—A special axial rotation table for pneumoencephalography, March, 472

**TAYLOR, RICHARD C.**. See FRAIMOW, WILLIAM

**TAYLOR, W. JAPE**. See BRENT, LAWRENCE B.

**TECHNICIANS**

—Third International Convention of X-Ray Technicians, Jan., 130; May, 830

**TEFLON TUBING**. See Cancer, radiotherapy

**TELEPAQUE**. See Gallbladder, roentgenography

**TELETERAPY**. See Radioactivity, radiocobalt; Radioactivity, radioceium

**TELEVISION**

—application of television in supervoltage therapy (ab), F. K. Baum and H. Kuttig, Feb., 341

—evaluation of performance of image Orthicon, Vidicon and Permachron television camera tubes in conjunction with fluoroscopic image intensifiers, Herbert M. Stauffer and George C. Henny, Feb., 209

—large field cineradiography and image intensification utilizing the TVX system, Joseph H. Weiss, Feb., 264

—roentgen television in surgery with special reference to stereotelevision (ab), K. Lindblom, April, 687

**TEMPLETON, ARCH W.**: Malignant mediastinal teratoma with bone metastases. A case report, Feb., 245

—See ORMOND, ROBERT S.

**TENG, CHING TSENG**, and **KARAMOURTJOUNIS, JEAN**: Quantitative effect of iodinated opaque media on thyroid uptake of radioiodine (ab), Jan., 170

—and **NATHAN, M.**, **HERBERT**: Primary hyperparathyroidism (ab), Feb., 328

**TENG, PAUL**: Spontylosis of the cervical spine with compression of the spinal cord and nerve roots (ab), Feb., 330

—and **GOLDENBERG, ERWIN D.**: Thrombosis of internal carotid artery in a five-year-old child (ab), Jan., 151

—and **RUDNER, NATHAN**: Multiple arachnoid diverticula (ab), Jan., 162

**TERATOMA**. See Tumors, teratoma

**TERIDAX**. See Bile Ducts, roentgenography

**TERRY, BOYD E.**. See TERRY, CAROLYN W.

**TERRY, CAROLYN W.**, **TERRY, BOYD E.**, and **DAVIES, JACK**: Transfer of zinc<sup>65</sup> across the placenta and fetal membranes of the rabbit (ab), Feb., 346

**TESTES**

See also Gonads

—damage and recovery of mouse testes after 1,000 r acute localized x-irradiation, with reference to restitutio cells, Sertoli cell increase, and Type A spermatogonial recovery (ab), Bernard R. Nebel and Carol J. Murphy, June, 997

—failure of AET to protect against testes injury in x-irradiated rat (ab), B. H. Ershoff and V. Brat, Feb., 349

—excision. See Castration

**tumors**

—cavography in cases of testis tumors (ab), Jorge Lockhart et al., Feb., 335

—recurrent seminoma: management of late metastasis, recurrence, or a second primary tumor (ab), Milton Friedman and Manish C. Purkayastha, Jan., 169

—skeletal metastases from malignant testicular tumors; 10 cases with osteolytic and osteoblastic changes (ab), Paul W. Sum et al., Feb., 329

—some clinical aspects of megavoltage: seminoma of testis (ab), Robert Gibb, Feb., 339

—tumors of testis (ab), Robert G. Parker and John B. Holyoke, Jan., 168

**THEANDER, GEORG**: Arteriographic demonstration of stationary arterial waves (ab), April, 669

Pseudonodules in precipitate of contrast medium in the gallbladder (ab), March, 510

—See ANDRÉN, LARS

—and **VEIGE, STEN**: Chemical demonstration of contrast medium precipitate in human gall bladders (ab), May, 849

**THIOCYANATE**

—response of thyroid gland to thiocyanate and thyrotropin (ab), Marvin L. Mitchell and Mary E. O'Rourke, Jan., 172

**THIOURACIL**

—effect of methythiouracil and iodide on iodinated constituents of thyroid tissue in Graves' disease (ab), E. Yamazaki et al., April, 692

**THIOUREA** —action of various goitrogens in inhibiting localization of radioiodine in thyroid and thymus glands of larval tree toads (ab), W. Gardner Lynn and James N. Dent, April, 693

**THOENY, ROBERT H., HODGSON, JOHN R., and SCUDAMORE, HAROLD H.** The roentgenologic diagnosis of gasterocolic and gastrojejunocolic fistulas (ab), April, 677

**THOMAS, E. DONNALL.** See MANNICK, JOHN A.

**THOMAS, D.** See ODDIE, T. H.

**THOMAS, R. GLYN.** See KAYE, JOSSE

**THOMPSON, JOHN O.** See IBARRA, JESSE D., JR.

**THOMPSON, THEOS J.** See BROWNELL, GORDON L.

**THOMPSON, W. A. L.** See PRITCHARD, A. E.

**THORACOPAGUS.** See Monsters

**THORAX** See also Bronchi; Heart; Lungs; Mediastinum  
diseases —postgraduate course, diseases of chest, University of Wisconsin, Feb., 305  
—sarcoidosis: experience at a naval hospital (ab), C. Charles Welch and Robert O. Canada, March, 498

**roentgenography.** See also Lungs, roentgenography; Thorax, wounds and injuries  
—absorbed dose in thoracic vertebrae in chest roentgenography, R. Wilson and J. A. Carruthers, March, 478  
—course in radiology of chest, Indiana University, March, 486  
—identification of "positives" in roentgenographic readings (ab), Joseph Berkson et al., March, 496  
—importance of radiographic examination of esophagus and routine chest radiography after esophagoscopy (ab), George Cohen and Joseph Katz, Feb., 320  
—misleading thoracic roentgenograms; cardiovascular abnormalities that may simulate diseases of lungs, bony thorax, mediastinum (ab), Corrin H. Hodgson et al., April, 603  
—roentgen findings in thorax in chronic leukoses (ab), H. Hartweg, March, 500

**wounds and injuries** —roentgen diagnosis of injuries of thorax due to blunt trauma (ab), Th. Döpper, March, 496

**THROMBOSIS** See also Embolism  
**axillary** —effort thrombosis of subclavian and axillary veins: review of literature and case report with two-year follow-up with venography (ab), David L. Crowell, April, 672

**carotid** —thrombosis of internal carotid artery in 5-year-old child (ab), Paul Teng and Erwin D. Goldenberg, Jan., 151

**mesenteric** —findings on plain roentgenograms of abdomen associated with mesenteric vascular occlusion with possible new sign of mesenteric venous thrombosis (ab), Sidney W. Nelson and William Eggleston, March, 504

**subclavian** —effort thrombosis of subclavian and axillary veins: review of literature and case report with two-year follow-up with venography (ab), David L. Crowell, April, 672

**THYMUS** —action of various goitrogens in inhibiting localization of radioiodine in thyroid and thymus glands of larval tree toads (ab), W. Gardner Lynn and James N. Dent, April, 693

**effects of irradiation** —carcinoma of the thyroid gland in childhood: its relation to radiotherapy (ab), Russell Howard, March, 527

**HYDROGLOBULIN** —serum "thyroglobulin" in thyroidal carcinoma (ab), Charles A. Owen, Jr., et al., Jan., 172

**HYDROXYL** See also Goiter; Goiter, Exophthalmic  
—effect of methythiouracil and iodide on iodinated constituents of thyroid tissue in Graves' disease (ab), E. Yamazaki et al., April, 692

**aberrant** —iodine metabolism in ectopic thyroid (ab), T. Dorts et al., Jan., 171

**cancer** —carcinoma of thyroid gland in childhood: its relation to radiotherapy (ab), Russell Howard, March, 527

—induction of neoplasms in rat thyroid glands by low doses of radioiodine (ab), G. D. Potter et al., March, 525

—leukemia after  $I^{131}$  therapy for thyroid cancer (ab), A. M. Jelliffe and K. M. Jones, Feb., 343

—results of x-ray treatment in undifferentiated carcinoma of thyroid, Magnus I. Smedal and William A. Meissner, June, 927

—role of x-ray therapy to neck region in production of thyroid cancer in young people: 37 cases (ab), E. Hunter Wilson and Samuel P. Asper, Jr., April, 696

—serum "thyroglobulin" in thyroidal carcinoma (ab), Charles A. Owen, Jr., et al., Jan., 172

—thyroid cancer after irradiation in adult life (ab), A. M. Jelliffe and K. M. Jones, June, 995

**diseases** —radioactive iodine studies in diagnosis of Hashimoto's thyroiditis (ab), I. P. C. Murray and E. M. McGirr, Feb., 343

—studies on proteins of normal and diseased thyroid glands (ab), Leslie J. DeGroot and Evelyn Carvalho, Jan., 172

**ectopic.** See Thyroid, aberrant

**function.** See also Thyroid, diseases; Thyroid, hyperthyroidism; etc.  
—comparison of 15-minute continuous thyroid uptake test with other radioiodine tests (ab), N. Howard et al., March, 523

—diagnostic limits for thyroidal radioiodine uptake rates (ab), T. H. Oddie et al., Feb., 342

—effect of diuretics upon serum protein-bound iodine and thyroidal uptake of radioactive iodine (ab), David E. Schteingart et al., June, 994

—effect of several thyroxine analogues upon thyroidal  $I^{131}$  uptake in man (ab), Stanley Slater et al., Feb., 342

—effect of 2,3-dimercaptopropanol (BAL) on thyroid function (ab), James V. Current et al., Jan., 171

—iodine-containing contrast media and the interference of Teridox for cholangiograms in evaluation of thyroid function by measurement of serum iodine (ab), Evelyn B. Man, Jan., 165

—quantitative effect of iodinated opaque media on thyroidal uptake of radioiodine (ab), Ching Tseng Teng and Jean Karamourdjou, Jan., 170

—radioiodine tracer tests in evaluation of thyroid function: result of 6-hour and 24-hour uptake determinations in 357 patients (ab), Jesse D. Ibarra, Jr., et al., Feb., 342

**hyperthyroidism.** See also Goiter, Exophthalmic  
—acute leukemia after radioactive iodine ( $I^{131}$ ) therapy for hyperthyroidism (ab), Thomas W. Burns et al., May, 862

—serious thyrotoxic crisis after therapeutic dose of  $I^{131}$  (ab), H. Goldschlag, Feb., 343

—varying responses to radioactive iodine ( $I^{131}$ ) therapy in hyperthyroid patients (ab), Melvin D. Cheitlin et al., Feb., 343

**physiology**  
—action of various goitrogens in inhibiting localization of radioiodine in thyroid and thymus glands of larval tree toads (ab), W. Gardner Lynn and James N. Dent, April, 693

—effect of salt feeding on thyroid metabolism of  $I^{131}$  in dog (ab), Joseph B. Boatman et al., April, 693

—effects of certain physical and emotional tensions and strains on fluctuations in level of serum protein-bound iodine (ab), Robert Volpé et al., Feb., 342

—response of thyroid gland to thiocyanate and thyrotropin (ab), Marvin L. Mitchell and Mary E. O'Rourke, Jan., 172

**HYDROXYLITIS.** See Thyroid, diseases

**HYDROXYLONE** —metabolism of triiodothyronine in Graves' disease (ab), Ian B. Hales and Brown M. Dobyns, Jan., 171

**HYDROXYLICOSIS.** See Thyroid, hyperthyroidism

**HYDROXYLROPIN.** See Pituitary Preparations

**HYDROXYLON** —effects of several thyroxine analogues upon thyroidal  $I^{131}$  uptake in man (ab), Stanley Slater et al., Feb., 342

**TIBIA** —deformity of medial tibial condyle in 19 cases of gonadal dysgenesis (Turner's syndrome) (ab), Jerzy Kosowicz, April, 683

**tuberosity** —manifestations of Osgood-Schlatter's disease in late teen age and early adulthood (ab), B. F. Woolfrey and E. F. Chandler, Jan., 161

**TICE, GALEN M.**: Cancer of the breast: radiation therapy of carcinoma of the breast supplementing surgery (ab), Feb., 337

**TINDALL, GEORGE T., and CUPP, HORACE B., Jr.**: Vertebral arteriography by retrograde injection of the right common carotid artery, May, 742

**TING, YOEH MING**: Osteomyelitis of the spine, Jan., 27

**TISSUE** —quantitative measurements of oxygen in normal tissues and in tumors of patients before and after radiotherapy (ab), Donald B. Carter and Ian A. Silver, Jan., 177

—tissue isodoses curves for beta surface applicators, Wesley G. McTaggart, Walton D. West, Harry A. Claypool and Vincent P. Collins, Feb., 278

**culture** —studies on effects of radiation on living cells in tissue culture.  
I. Radiosensitivity of various imaginal disks and organs in larvae of *Drosophila melanogaster* (ab), Masakatsu Horikawa and Tsutomu Sugahara, May, 865

**TIZINELLO, A.** See FIESCHI, A.

**TOCHILIN, E.** See ALPEN, E. L.

**TOFFLER, ALLAN H.** See GOULD, JOHN

**TOIGO, ANGELO**: Pulmonary aspergillosis (ab), March, 498

**TOMOGRAPHY.** See Body-Section Roentgenography

**TONSILLECTOMY.** See Tonsils

**TONSILS** —blood loss during adenoidectomy and tonsillectomy measured with radioisotopes (ab), R. L. Ruggles, April, 694

**cancer** —technic of irradiation of epitheliomas of tonsil by combined external high-energy roentgen therapy (betatron, 22 Mev) and interstitial curie therapy ( $Au^{198}$  wires). Application of concept of two-volume targets (ab), B. Pierquin and M. Gasiorowski, April, 689

**TOOMEY, FRANCES B., and FELSON, BENJAMIN**: Osteoblastic bone metastasis in gastrointestinal and bronchial carcinoids (ab), Feb., 329

**TORD, OLIN.** See JEPSSON, P. G.

## TOXINS

—delayed hypersensitivity. V. Effects of x-irradiation on development of delayed hypersensitivity and antibody formation (ab), Jonathan W. Uhr and Matthew Scharff, June, 998

## TRACHEA

—injuries of trachea and major bronchi (ab), R. Maurice Hood and Herbert E. Sloan, Feb., 314

## obstruction

—arterial malformation in superior mediastinum (compressing trachea) (ab), S. Brünner et al., Jan., 148

## stricture

—expiratory stenosis of trachea and main stem bronchi due to weakened para membranacea: its treatment by plastic reinforcement (ab), H. Herzog, Jan., 146

**TRACY, G. D., KALOKERINOS, JAMES, and HARRISON, F.:** Correlation of radiographic findings with clinical features of degenerative arterial disease (ab), March, 502

—See **KALOKERINOS, JAMES**

**TRAENKLE, H. L., and MULAY, DATTATREYA:** Further observations on late radiation necrosis following therapy of skin cancer. The results of fractionation of the total dose (ab), April, 695

## TRAUMA

See also Aneurysm, aortic; Kidneys, wounds and injuries; Thorax, wounds and injuries; etc.

—unrecognized trauma in infants and children (ab), Donald H. Altman and Richard L. Smith, Feb., 327

**TREMBLAY, P. C.:** See **ARRONET, G. H.**

**TRENTA, A.:** See **di GUGLIELMO, L.**

**TRICHEL, B. E.:** See **KNIGHT, CHARLES D.**

**TRICKEY, S. E.:** See **HODSON, C. J.**

## TRIOLEIN

—<sup>141</sup> triolein tolerance curves in patients with diabetes mellitus: their similarity to those in myocardial infarction (ab), Herschel Sandberg et al., April, 693

—use of radioactive iodine labeled triolein in evaluation of fat absorption following cholecystectomy (ab), E. J. Fedor and Bernard Fisher, June, 993

## TRIPLETS

—roentgen investigation of pregnancy with triplets, including a twin thoracopagus (ab), G. Agati and D. Prigione, June, 989

**TRIPLOIDY.** See Chromosomes

**TRIQUETRUM.** See Wrist

## TRITIUM

—effects of x-rays and beta rays (tritium) on growth of Rickettsia mooseri and Rickettsia akari in embryonate eggs (ab), Donald Greiff et al., April, 702

**TROPHOBLASTS.** See Cancer, choriocarcinoma

**TROUT, E. DALE, KELLEY, JOHN P., and LUCAS, ARTHUR C.:** Conventional building materials as protective radiation barriers, Feb., 237

**TRUEMNAR, KEITH M., WHITE, STANLEY, and VANLANDINGHAM, HOMER:** Fatal embolization of pulmonary capillaries. Report of case associated with routine barium enema (ab), May, 848

**TRUMP, JOHN G., WRIGHT, KENNETH A., SMEDAL, MAGNUS I., and SALZMAN, FERDINAND A.:** Synchronous field shaping and protection in 2-million-volt rotational therapy, Feb., 275

**TSAI, J. P.:** See **SCHULZ, R. J.**

**TSAI, S. H., COHEN, SUMNER S., and YUE, W. Y.:** Bronchographic patterns following resection for pulmonary tuberculosis (ab), March, 497

**TSUKAHARA, ISAMU:** A histopathological study on the prognosis and radiosensitivity of retinoblastoma (ab), April, 689

**TUBERCULOSIS, PULMONARY**

—new face of tuberculosis (ab), F. T. Roque, June, 986

## surgical therapy

—bronchographic patterns following resection for pulmonary tuberculosis (ab), S. H. Tsai et al., March, 497

**TUBES.** See Roentgen Rays, apparatus

**TUCKER, ARTHUR S., and BOLANDE, ROBERT P.:** Duodenal polypoid associated with mucocutaneous melanosis (Peutz-Jeghers syndrome) (ab), Jan., 154

**TUDDENHAM, WILLIAM J., and CALVERT, WILLIAM P.:** Visual search patterns in roentgen diagnosis, Feb., 255

**TUMEN, H.:** See **KALSER, M. H.**

**TUMEN, HENRY J., STEIN, GEORGE N., and SHLANSKY, ELLIOTT:** X-ray and clinical features of hiatal hernia. Significance of hiatal hernias of minimal degree (ab), April, 681

## TUMORS

See also Cancer; Sarcoma; and under organs and regions

## adamantinoma

—adamantinoma of capitate bone (ab), W. P. Diepveen et al., April, 682

**adenoma.** See also Parathyroid, tumors

**sebaceous.** See Sebaceous Glands

## angioma

—influence of x-ray contact therapy of hemangiomas on growing skeleton (ab), Jaromír Kolář and Václav Bek, April, 695

—lymphangioma of bone, Charles E. Shopfner and R. Parker Allen, March, 449

**carcinoïd.** See Gastrointestinal Tract, cancer; Intestines, cancer

## cholesteatoma

—epidermoid cyst of skull; case observed for 16 years, Benjamin E. Greenberg, Jan., 107

**chorioadenoma destruens.** See Cancer, choriocarcinoma

## dermoid

—occipital dermal sinus: clinical and radiological findings when a complete occipital dermal sinus is associated with a dermoid cyst (ab), George F. Smith and Donald H. Altman, Jan., 142

**dyssgerminoma.** See Tumors, seminoma

**epidermoid.** See Tumors, cholesteatoma

**epithelioma.** See Maxillary Sinus; Skin, cancer; Tonsils

## experimental

—do estrogenic and androgenic hormones affect the radiation reaction of tumors? Henry P. Plenk, Fred M. Sorenson and Roger B. Finsen, Feb., 270

—observations on the antitumor effect of N-dichloroacetyl-DL-serine (FT-9045), H. Blondal, I. Levi, J. P. A. Latour and W. D. Fraser, June, 945

—some aspects of microcirculation of a transplantable experimental tumor, Morton M. Kligerman and Cora K. Henel, May, 810

## fibroma

—congenital generalized fibromatosis: case report, with roentgen manifestations, Virgil R. Condor and R. Parker Allen, March, 444

—nasopharyngeal fibroma: its malignant potentialities and radiation therapy (ab), F. E. Massoud and H. K. Awwad, June, 992

## giant-cell

—giant-cell lesions of bone: osteoclastoma and giant-cell tumor variants. Survey of a radiotherapeutic series (ab), J. Walter, March, 519

## hemangiopericytoma

—primary hemangiopericytoma of bone: review of literature and report of first case with metastases (ab), Raul A. Marcial-Rojas, Feb., 328

## in animals

—studies on radiation-induced mammary gland neoplasia in rat. I. Role of the ovary in neoplastic response of breast tissue to total- or partial-body x-irradiation (ab), E. P. Cronkite et al., April, 701

—studies on radiation-induced mammary gland neoplasia in rat. II. The response of castrate and intact male rats to 400 r of total-body irradiation (ab), C. J. Shellabarger et al., April, 701

—studies on radiation-induced mammary gland neoplasia in the rat. III. Relation of neoplastic response to dose of total-body radiation (ab), V. P. Bond et al., May, 862

**lymphangioma.** See Tumors, angioma

**lymphoblastoma**

—follicular. See Lymph Nodes

**lymphogranuloma.** See Hodgkin's Disease

**melanoma**

—clinical picture and prospect of cure of malignant melanoma (ab), Werner Hellriegel, April, 688

—<sup>141</sup> localization of malignant melanoma of the posterior choroid (ab), J. O'Rourke and Eleanor Collier, April, 694

—radioactive phosphorus in the *in vivo* diagnosis of melanoma of skin (ab), Earle W. Brauer et al., Feb., 344

**meningioma.** See Meninges, tumors

**metastases.** See Cancer, metastases; Testes, tumors; Tumors, hemangiopericytoma; Tumors, seminoma; Tumors, teratoma; etc.

**myeloma.** See Bones, marrow

**myxoma**

—myxoma of left atrium (ab), Harold E. Aldridge and William F. Greenwood, April, 665

—right atrial myxoma: diagnosis during life; successful surgical removal (ab), Hyman Ashman et al., Feb., 318

**neurinoma.** See Nerves, acoustic

**osteoclastoma**

—giant-cell lesions of bone: osteoclastoma and giant-cell tumor variants. Survey of a radiotherapeutic series (ab), J. Walter, March, 519

**pheochromocytoma.** See Adrenals, tumors

**polyp**

—diagnosis and results of treatment in gastric polyps (ab), Edward G. Huppert et al., Jan., 154

—duodenal polypoid associated with mucocutaneous melanosis (Peutz-Jeghers syndrome) (ab), Arthur S. Tucker and Robert P. Bolande, Jan., 154

—frequency of polyps of colon in ulcerative colitis (ab), L. André and S. Welin, March, 508

—malignant disease and gastric polyps (ab), Leonard Breslaw, April, 676

—value of routine lateral rectal projection in barium-enema study (ab), Henry C. Forrester and A. Bradley Soule, March, 508

**retinoblastoma.** See Retina

**seminoma**

—dyssgerminoma of ovary: unusual roentgen manifestation of metastases (ab), S. B. Feinberg, March, 522

—recurrent seminoma: management of late metastasis, recurrence, or a second primary tumor (ab), Milton Friedman and Manish C. Purkayastha, Jan., 169

—some clinical aspects of megavoltage: seminoma of testis (ab), Robert Gibb, Feb., 339

**teratoma**

—malignant mediastinal teratoma with bone metastases; case, Arch W. Templeton, Feb., 245

**trophoblastic.** See Cancer, choriocarcinoma

**Wilms'.** See Kidneys, tumors

**TURIAF,** art  
mar  
phi

**TURNER,** Tyler  
me

**TYLER,** See

**TYTOR,** M

**TIROSIN**

—defec

(al)

—effect

zal

ULCERS

pedic

ULM,

Am

m

UNGER

UNITS

—Int

URINE

—acute

URETE

URETE

See

canc

—b

dila

—rec

(diver

—refu

—abo

—me

—ure

—wou

—py

—p

URET

roent

—flu

URIN

—ac

—co

URIN

gas

—p

UROG

UROG

UTER

abu

—p

blow

—p

can

—a

**TURIAF, J., MARLAND, P., and BASSET, G. (Mme.):** Periarteritis nodosa with labile and recurrent pleuropulmonary manifestations without asthma or serum hypereosinophilia (ab), Feb., 316

**TURNER SYNDROME.** See Infantilism

**TYLER, S. A., and STEARNER, S. P.:** Modes of radiation death in the chick embryo. II. A model of lethal mechanisms (ab), May, 865

—See STEARNER, S. P.

**TYTOR, MALCOLM P.** See JANSSEN, BENNO, Jr.

**TYROSINE AND TYROSINE COMPOUNDS**

—defective iodination of tyrosine a cause of nodular goiter? (ab), John C. Floyd, Jr., et al., April, 692

—effect of methythiouracil and iodide on iodinated constituents of thyroid tissue in Graves' disease (ab), E. Yamazaki et al., April, 692

## U

**UHLEY, HERMAN N., REICH, STANLEY B., and RIVKIN, LAURENCE:** Radioautography of the conduction system of the dog's heart with I-131 (ab), March, 526

**UHR, JONATHAN W., and SCHARFF, MATTHEW:** Delayed hypersensitivity. V. The effect of x-irradiation on the development of delayed hypersensitivity and antibody formation (ab), June, 998

**ULCERS**

—peptic. See Peptic Ulcer

**ULM, AARON HARDY, and WAGSHUL, ELY C.:** Pulmonary embolization following urethrography with an oily medium (ab), May, 856

**UNDER, SOL M.** See SUM, PAUL W.

**UNITS OF RADIATION**

—International Commission on Radiological Units and Measurements, report of Subcommittee IV of ICRU, on "Method of Focal Spot Image Formation and Measurement," Jan., 125

**URANIUM**

—acute tubular and glomerular lesions in rat kidneys after uranium injury (ab), Sergio A. Bencosme et al., April, 699

**URETEROCELE.** See Ureters, dilatation

**URETERS**

—See also Pyelography

—cancer

—ureteral metastasis from renal adenocarcinoma presenting a bizarre urogram (ab), James W. Sargent, Jan., 163

—dilatation

—roentgen diagnosis of ureterocele and some impeding factors (ab), Arne E. Nilson, Feb., 334

—diverticula

—multiple ureteral diverticula (ab), Patrick A. Dolan and W. E. Kirkpatrick, March, 515

—reflux

—absence of vesicoureteral reflux in normal adult males (ab), Guy W. Leadbetter, Jr., et al., May, 854

—megacystis syndrome (ab), Albert J. Paquin, Jr., et al., March, 516

—ureteric reflux in paraplegic (ab), J. Cosbie Ross et al., March, 515

—wounds and injuries

—pyelographic study of ureteric injuries sustained during hysterectomy for benign conditions (ab), Edward Solomons et al., May, 855

**URETHRA**

—roentgenography

—automatic device (P-O-mat) for voiding urethrography in infants and small children, J. Scott Dunbar, Richard B. Goldblom, Victor Pollock and Rex Radford, March, 467

—pulmonary embolization following urethrography with an oily medium (ab), Aaron H. Ulm and Ely C. Wagshul, May, 856

**URETHROGRAPHY.** See Urethra

**URINARY TRACT**

—See also Bladder; Kidneys; Pyelography; Ureters

—roentgenography

—fluoroscopic examination of urinary tract (ab), Alvin C. Wyman and Christian V. Cimmino, Feb., 333

**URINATION**

—automatic device for voiding urethrography in infants and small children, J. Scott Dunbar, Richard B. Goldblom, Victor Pollock and Rex Radford, March, 467

—congenital bladder neck obstruction: diagnosis by delayed and voiding cystography and surgical removal by use of a new cold, crush-cutting punch (ab), Charles M. Stewart, March, 516

**URINE**

—gases

—primary diabetic pneumaturia diagnosed radiographically (ab), Albert P. Marsh, Jan., 163

**UROGRAFIN.** See Iodine and Iodine Compounds, toxicity

**UROGRAPHY.** See Kidneys, roentgenography; Pyelography

**UTERUS**

—abnormalities

—pneumopelvigraphy of developmental malformations of female internal genitalia (ab), M. Henzl et al., Jan., 162

—blood supply

—pelvic arteriography in gynecologic conditions (ab), N. Macarini et al., June, 988

**cancer**

—adenocarcinoma of uterine cervix (ab), Dietrich Buttenberg, March, 520

—alteration in glucose tolerance produced by irradiation of pelvis (ab), Lilia Lopez Borja et al., Feb., 347

—cervical cancer: cytologic prognosis (ab), Ruth M. Graham, March, 521

—cervical cancer: isodose curves for certain radium applicators used in treatment (ab), Norman A. Baily and Virgil E. Yoder, Jan., 167

—cervical cancer: sensitization response (ab), John B. Graham and Ruth M. Graham, April, 690

—cervical cancer: space dose relationships for points A and B in radium therapy (ab), George C. Lewis, Jr., et al., Jan., 167

—cervical carcinoma: bioassay of host radiosensitivity, an index of radiocurability (ab), Hugh J. Davis et al., Feb., 339

—cervical carcinoma: characteristic bone lesions in post-irradiated carcinoma of the cervix: metastases versus osteonecrosis, Philip Rubin and Dusdee Prahasawat, May, 703

—cervical carcinoma: combined radiosurgical treatment (ab), G. R. Kurle, April, 690

—cervical carcinoma: new packing and spacing material; preliminary report, J. C. Weisman, April, 640

—cervical carcinoma: treatment with radium and telecobalt (ab), G. Ambesi Impiombato et al., June, 993

—chorionic. See Cancer, chorionic

—hypogastric arteriography prior to continuous infusion of malignant tumors of uterine cervix and vagina; preliminary report (ab), Paul R. Zeit et al., May, 846

—report of therapeutic results in carcinoma of uterus following increased radiation dosage (ab), F. Roth and G. Egger, Jan., 167

**cervix.** See Uterus, cancer

**excision**

—pyelographic study of ureteric injuries sustained during hysterectomy for benign conditions (ab), Edward Solomons et al., May, 855

**hydatiform mole**

—iodine metabolism in hydatiform mole and choriocarcinoma (ab), J. Thomas Dowling et al., Jan., 173

**UYEKI, EDWIN M., KEY, HARVEY, and SALERNO, PAUL R.:** In vitro leucine incorporation into protein of normal and x-irradiated rabbit bone marrow cells (ab), Feb., 349

## V

**VAETH, JEROME M., FEIGENBAUM, LAWRENCE Z., and MERRILL, MALCOLM D.:** Effects of intensive radiation on the human heart, May, 755

**VAGINA**

**cancer**

—hypogastric arteriography prior to continuous infusion of malignant tumors of uterine cervix and vagina; preliminary report (ab), Paul R. Zeit et al., May, 846

—primary carcinoma of vagina (ab), G. H. Aronet et al., March, 521

**VAJDA, D., NAGY, E., and MOLNÁR, G.:** Gastric stump carcinoma (ab), April, 676

**VALE, JOAN.** See VULPÉ, ROBERT

**VALENTE, M.** See HENZL, M.

**VALSALVA MANEUVER**

—goiter plongeant: goiter demonstrated by Valsalva maneuver (ab), Henry T. Perkins, Jr., et al., Jan., 143

**VAN BUSKIRK, CHARLES.** See OTOMO, EIICHI

**VAN DE BERG'S TECHNIC.** See Knee, roentgenography

**Van den BREK, H. A. S., and MINTY, C. C. J.:** Radiation in the management of keloid and hypertrophic scars (ab), March, 517

**Van der WOLK, M.** See VERLOOP, M. C.

**VAN DYKE, RHODA H.** See COPENHAVER, W. M.

**VAN HOOSER, E. N.** See LOGIE, L. C.

**VANLANDINGHAM, HOMER.** See TRUEMNER, KEITH M.

**VANNOTTI, A.** See DORTA, T.

**VARGAS, LESTER L., and FORSYTHE, THOMAS:** A syringe heater for angiography, Feb., 248

**VARICOCELE**

—varicocele of broad ligament: a venographic study (ab), C. G. Helander and Å. Lindblom, Jan., 163

**VARLEY, WILLIAM JOSEPH:** The importance of cervical myelopathy in cervical and upper thoracic nerve root avulsion, March, 376

**VARTIO, T., VIRTANEN, M., and AHO, A.:** Clinical significance of roentgenological hiatus hernia (ab), Jan., 158

**VAS, E.** See WEINBERG, H.

**VAS DEFERENS**

—calcification of vas deferens in diabetes (ab), Gordon J.

—Culver and Joseph Tannenhaus, April, 685

**VEIGE, STEN.** See THEANDER, GEORG

**VEINS**

—See also Portal Vein; Venae Cavae

**axillary.** See Thrombosis

**calculi**

—identification of pelvic masses by phlebolith displacement (ab), Howard L. Steinbach, April, 673

**cerebral.** See Brain, blood supply; Brain, tumors

**coronary.** See Coronary Vessels

**iliac**

—compression of common iliac vessels by dilatation of bladder; case (ab), Erik Carlsson and Per Garsten, April, 685

VEINS—cont.

mesenteric

- experimental study of diagnosis of mesenteric infarction (ab), Karel E. Absolon et al, March, 505
- findings on plain roentgenograms of abdomen associated with mesenteric vascular occlusion with possible new sign of mesenteric venous thrombosis (ab), Sidney W. Nelson and William Eggleston, March, 504

pulmonary

- differentiation of interatrial communications by clinical methods: ostium secundum, ostium primum, common atrium, and total anomalous pulmonary venous connection (ab), James W. DuShane et al, Jan., 147
- pulmonary veins in congenital heart disease in the adult, Robert S. Ormond, Andrew K. Poznanski and Arch W. Templeton, June, 885
- “snowman” heart: manifestation of total anomalous pulmonary venous connection (ab), Richard L. Golden and Charles A. Bertrand, April, 665
- total anomalous pulmonary venous drainage into the portal system, Bertram Levin and Harvey White, June, 894

roentgenography. See Extremities, blood supply; Eyes, blood supply; Pelvis, blood supply; Portal Vein; Thrombosis; Veins, vertebral; Venae Cavae; etc.

subclavian. See Thrombosis

vertebral

- evaluation of vertebral venography (ab), M. H. Nathan and Luis Blum, April, 671

VELIT, ERNESTO. See MOREY, GILBERTO

VENAE CAVA

- cavography in cases of testis tumors (ab), Jorge Lockhart et al, Feb., 335
- collateral circulations in obstructive syndromes of superior vena cava and its larger branches (ab), G. F. Garusi, April, 668
- inferior vena cavography in preoperative localization of pheochromocytoma (ab), Ronald R. Lund et al, March, 517

VENOGRAPHY. See Eyes, blood supply; Pelvis, blood supply; Portal Vein; Thrombosis; Veins; Venae Cavae; etc.

VENTRICULOGRAPHY. See Brain, roentgenography

VERLOOP, M. C., Van der WOLK, M., and HEIER, A. J.: Radioactive iron studies in patients with iron deficiency anemia with concurrent abnormal hemolysis (ab), June, 994

VERNEY, G. I. See BARRETT, A. F.

VERTEBRA. See Spine

VICKERS, RAYMOND. See BURNS, THOMAS W.

VIDICON TUBE. See Television

VIEHWEGER, G.: Roentgen findings after pulmonary surgical procedures (ab), May, 841

VIRTANEN, M. See VARTIO, T.

VISCERA

- studies in visceral arteriography (ab), Murray W. Seitchik et al, June, 987

VISUAL SEARCH PATTERNS

- visual search patterns in roentgen diagnosis, William J. Tuddenham and William P. Calvert, Feb., 255

VITAL CAPACITY

- relationship of hyperinflated lung to obstructive pulmonary disease (ab), Neville M. Lefcoe and Gerald Goodall-Copestake, Jan., 144

VITALE, PETER. See BLUTH, IRWIN

VITAMINS

B<sub>12</sub>

- kinetics of intravenously injected radioactive vitamin B<sub>12</sub>: studies on normal subjects and patients with chronic myelocytic leukemia and pernicious anemia (ab), Eugene A. Brody et al, June, 995

VOCAL CORDS

- asymmetric roentgenography of vocal cords (ab), Ákos Kovács, April, 660

VOGEL, K.-H., and FLINK, E.: Roentgen changes in the thorax in periarteritis nodosa (ab), March, 499

VOLPÉ, ROBERT, VALE, JOAN, and JOHNSTON, MacALLISTER W.: The effects of certain physical and emotional tensions and strains on fluctuations in the level of serum protein-bound iodine (ab), Feb., 342

VOLVULUS. See Intestines, volvulus; Stomach, volvulus

von ESEN, CARL F.: Roentgen therapy of skin and lip carcinoma: factors influencing success and failure (ab), Jan., 165

VOROBIEV, E. I.: Organization of radiotherapeutic service for the [Russian] population (ab), March, 523

VOSE, GEORGE P., MACK, PAULINE BEERY, BROWN, SIDNEY O., and MEDLEN, AMMON B.: Radiographic determination of the rate of bone healing, May, 770

VRABEC, R. See KOLÁR, JAROMÍR

VULPE, M., HAWKINS, A., and ROZDILSKY, B.: Permeability of cerebral blood vessels in experimental allergic encephalomyelitis studied by radioactive iodinated bovine albumin (ab), Jan., 173

W

WACHOWSKI, THEODORE J.: Introduction of Carman lecturer and gold medalist, Warren H. Cole, M.D., March, 351

WAGSHUL, ELY C. See ULM, AARON HARDY

WALKER, HARRY R.: Extradural osseous lesions simulating the disk syndrome (ab), Jan., 160

WALKER, W. F., STEWART, W. K., MORGAN, H. G., and MCKIE, J.: Clinical assessment of intestinal fat-absorption using radioactive fat (ab), March, 524

WALKO, R.: Contribution to the roentgen diagnosis of the annular pancreas with respects of two cases, one with an unusually large duodenal dilatation (ab), Feb., 326

WALLACE, H. D. See NEWLAND, H. W.

WALLACE, SIDNEY, JACKSON, LAIRD, SCHAFER, BURTON, GOULD, JOHN, GREENING, ROY R., WEISS, ARTHUR, and KRAMER, SIMON: Lymphograms: their diagnostic and therapeutic potential, Feb., 179

WALLGREN, ELSIE. See HOLMBERG, BO

WALSH, JOHN M. See BOATMAN, JOSEPH B.

WALTER, J.: Giant-cell lesions of bone. Osteoclastoma and giant-cell tumour variants. Survey of a radiotherapeutic series (ab), March, 519

WANG, C. C., and REEVES, JOHN D.: Mesenteric vascular disease (ab), March, 504

WASSERMAN, LOUIS R. See BRODY, EUGENE A.

WATER

- residual contrast medium in bowel in cholecystography with iopanoic acid and certain related substances (importance of properties of water) (ab), Lars Andrén and Georg Theander, April, 680

WATERHOUSE, KEITH. See HAMM, FRANK C.

WEAVER, JOHN C., KAMM, MICHAEL L., and DOBSON, R. LOWRY: Excretion of radioiodine in human milk (ab), May, 860

WEBSTER, B. H.: Pleuropulmonary amebiasis. A review with an analysis of ten cases (ab), March, 499

WEDGE FILTERS. See Larynx, cancer; Maxillary Sinus, cancer; Radioactivity, radiocobalt

WEDGES. See Roentgen Rays, apparatus

WEDGWOOD, JOHN. See JONES, ARTHUR

WEGLINSKI, C. See KOIVISTO, E.

WEIDMAN, WILLIAM W. See DU SHANE, JAMES W.

WEINBERG, H., FRANKEL, M., MAKIN, M., and VAS, E.: Familial epiphysial dysplasia of the lower limbs (ab), March, 515

—See SCHWARTZ, A.

WEINBERG, SIDNEY R. See HAMM, FRANK C.

WEISMAN, J. C.: A new packing and spacing material for use in carcinoma of the cervix uteri. Preliminary report, April, 640

WEISS, ARTHUR. See WALLACE, SIDNEY

WEISS, JOSEPH H.: Large field cineradiography and image intensification utilizing the TXV system, Feb., 264

WELCH, C., CHARLES, and CANADÁ, ROBERT O.: Sarcoïdosis. Experience at a naval hospital (ab), March, 498

WELIN, SÖLVE: Roentgen diagnosis of paranasal sinuses (ab), March, 494

—See ANDRÉN, LARS

WENGER, P. See ROTH, H. W.

WEST, WALTON D. See McTAGGART, WESLEY G.

WESTON, A. J.: Technical procedures of radiodiagnostic interest. A symposium. III. A brief summary of industrial radiography and automatic processing (ab), April, 686

WESTON, W. J.: Radiographic demonstration of Gartner's ducts (ab), June, 989

WHEATLEY, B. M.: Physical aspects of the use of caesium fission products in teletherapy (ab), May, 860

—JONES, J. C., and SINCLAIR, T. C.: A caesium 137 beam therapy unit. I. Physical aspects (ab), May, 860

WHEELER, DAVID E.: Bronchography using dyclomine hydrochloride anesthetic. (4-N-butoxy-beta-piperidino-propophenoxy-hydrochloride) (ab), Jan., 146

WHITE, HARVEY. See LEVIN, BERTRAM

WHITE, STANLEY. See TRUEMNER, KEITH M.

WHITLEY, JOSEPH E., and FORSYTH, H. FRANCIS: The classification of cervical spine injuries (ab), Feb., 330

—See WITCOFSKI, RICHARD L.

—WITCOFSKI, RICHARD L., and MESCHAN, I.: Experimental comparison of ortho-iodothiopuric acid and iodopropacet in renal function evaluation, March, 464

WIER, JAMES A.: Congenital anomalies of the lung (ab), Jan., 43

WITERSEN, F. See REYNOLDS, R. M.

WILCOX, WILLIAM A. See O'LACO, J. P.

WILDER, ROBERT J., and STEICHEN, FELICIEN M.: Necrosis of the entire gastrointestinal tract following translumbar aortography (ab), Jan., 149

WILLIAMS, E. G. See SHARP, C. M.

WILLIAMS, I. G.: Retroperitoneal tumours (ab), Feb., 338

WILLIAMS, JACK. See MELAMED, MYRON

WILLIAMS, JOHN A., LITTMANN, DAVID, HALL, JACK H., BELLMAN, SVEN, LAMBERT, PETER B., and FRANK, HOWARD A.: Coronary arteriography. II. Clinical experiences with the loop-end catheter (ab), Jan., 150

—See BELLMAN, SVEN

WILLIARD, ROBERT F. See POLACHEK, ABRAHAM A.

WILLICH, E.: Changes in pneumonia in children as seen on the chest film (ab), March, 497

WILMS' TUMOR. See Kidneys, tumors

WILSON, E. HUNTER, and ASPER, SAMUEL P., Jr.: The role of x-ray therapy to the neck region in the production of thyroid cancer in young people. A report of thirty-seven cases (ab), April, 696

**WILSON, MIRIAM G., and MIKITY, VICTOR G.:** A new form of respiratory disease in premature infants (ab), Feb., 315

**WILSON, R., and CARRUTHERS, J. A.:** Absorbed dose in the thoracic vertebrae in chest roentgenography, March, 478

**WILSON, SLOAN J. See WINEINGER, JOHN H.**

**WILSON, STEPHEN G., Jr.:** Radiation-induced gastrointestinal death in the monkey (ab), Feb., 348

—See ALLEN, RALPH G.

**WINEINGER, JOHN H., WILSON, SLOAN J., and LARSEN, WILLIAM E.:** Isotope chromium<sup>51</sup>: the evaluation of selected anemias with radioactive material (ab), Feb., 345

**WING, M. See OPPENHEIM, H.**

**WINTER, CHESTER C.:** The excretory urogram as a kidney function test (ab), Jan., 164

**WINTERS, F. A. See SMULLEN, W. C.**

**WISOFF, CARL P.:** A comparative study of Telepaque dosage in cholecystography using single-dose and double-dose techniques (ab), Jan., 158

**WITCOFSKI, RICHARD L., WHITLEY, JOSEPH E., MESCHAN, I., and PAINTER, WILLIAM E.:** A method and parameters for the analysis of renal function by external scintillation detector technic, April, 621

—See WHITLEY, JOSEPH E.

**WITTEN, M. See RUBIN, GUSTAV**

—See SUTRO, C. J.

**WITTEN, VICTOR H. See BRAUER, EARLE W.**

**WOLF, BERNARD S., and COHEN, BERNARD R.:** Radiologic localization of the esophageal hiatus as determined by intraluminal pressure measurements, June, 903

—See KHILNANI, MANSHO T.

—See MARSHAK, R. H.

**WOLFSON, ALFRED W. See NAGLER, RICHARD**

**WOLLAEGEN, ERIC E. See GREEN, PAUL A.**

**WOLLIN, D. G. See LAMON, C. B.**

**WOLOSHIN, HENRY J. See STAUFFER, HERBERT M.**

**WOOD, ERNEST H. See DANIELS, VIRGIL C.**

—See JOHNSON, PHILIP M.

**WOODFREY, LOWELL A. See HEYSEL, ROBERT**

**WOODRUFF, ROBERT. See DJERASSI, ISAAC**

**WOOLFREY, B. F., and CHANDLER, E. F.:** Manifestations of Osgood-Schlatter's disease in late teen age and early adulthood (ab), Jan., 161

**WOOLNER, LEWIS B. See NOLAN, ROBERT B.**

**WORK IN PROGRESS**

Absorbed dose in thoracic vertebrae in chest roentgenography, R. Wilson and J. A. Carruthers, March, 78

A-P junction semiconductor radiation detector for use with beta- and gamma-ray-emitting isotopes, N. A. Baily and J. W. Mayer, Jan., 116

Calculation of isodoses distributions in interstitial implantations by a computer, Robert J. Shalek and Marilyn A. Stovall, Jan., 119

Calibration studies at medical therapy facility at Massachusetts Institute of Technology (MIT) reactor, Gordon L. Brownell, Charles Porter and Theos J. Thompson, Jan., 124

Cinecholedochography, Stevens S. Sanderson and Kenneth E. Gross, Feb., 267

Cobalt-60 depth-dose correction as determined by transmission dose measurements, R. J. Schulz, G. A. Cohen, J. P. Tsai and J. C. Evans, Jan., 117

Considerations of shielding for cesium-137 sources, containing cesium 134, R. A. Beique and M. N. Lougheed, Feb., 281

Continuous monitored dialysis-perfusion device for study of two compartment systems, Ervin Kaplan and John J. Iamisario, Jan., 123

Do estrogenic and androgenic hormones affect the radiation reaction of tumors? Henry P. Plenk, Fred M. Sorenson and Roger B. Fuson, Feb., 270

Dose distribution in grid therapy with 15- to 33-Mev electrons, J. Ovadia and J. McAllister, Jan., 118

Dual-purpose cesium unit for radiotherapy, C. L. Ash, D. J. Wright and H. E. Johns, Feb., 284

Effect of radiation on metastatic pelvic lymph nodes judged by pelvic venograms, Sumner Holtz, William E. Powers and Alfred I. Sherman, Feb., 287

Effectiveness of mass survey of diagnostic x-ray equipment in promoting radiation safety, C. M. Sharp, E. G. Williams and J. R. Knapp, Jan., 121

Evaluation of performance of image Orthicon, Vidicon and Permacron television camera tubes in conjunction with fluoroscopic image intensifiers, Herbert M. Stauffer and George C. Henry, Feb., 269

Further experimental and early clinical observations concerning the protective action of low molecular weight dextran upon intravenous Hyaque toxicity, Eugene F. Bernstein, Robert L. Evans, John A. Blum and Robert F. Avant, Feb., 260

High dose rate x-ray sources with development of a lightweight diagnostic unit, W. P. Dyke, Ross Floyd and F. J. Grundhauser, Feb., 257

"Ideal" in vivo dosimetry system for clinical and experimental radiation therapy, B. Roswit, S. J. Malsky, C. G. Amato, C. B. Reid, L. Maddalone and C. Spreckels, Feb., 295

**In vitro effects of irradiation combined with actinomycin D.** Paul Y. M. Chan and Edwin J. Leibner, Feb., 273

Large field cineradiography and image intensification utilizing the TVX system, Joseph H. Weiss, Feb., 264

Motility changes revealing esophagogastric junction, Majic S. Potsaid, Goro Irie and Nathan T. Griscom, Feb., 262

Multiple implant dosimetry, C. G. Amato, S. J. Malsky, V. P. Bond, and B. Roswit, Feb., 292

New simple radiation scanning system, T. Fields, G. Clayton and J. Kenski, Jan., 122

Photographic method of measuring fluoroscopic dose to patient, Hanson Blatz and Edward R. Epp, Jan., 120

Practical uses for the radiation polymerization dosimeter in radiation therapy, Frank E. Hoecker, Jan., 116

Radioisotope concentration gradient analyzer—design and application, Rosalyn S. Yalow and Solomon A. Berson, Jan., 123

Radiological physics at an oceanographic institution, T. R. Folsom, R. A. Cramer and G. J. Mohanrao, Jan., 121

Radiophotoluminescent gamma-ray dosimetry of mixed neutron gamma-ray radiation fields, C. G. Amato and S. J. Malsky, Feb., 290. See also correction, May, 830

Solid-state and proportional beta detectors for use in vivo, C. V. Robinson, March, 479

Synchronous field shaping and protection in 2-million-volt rotational therapy, John G. Trump, Kenneth A. Wright, Magnus I. Smedal and Ferdinand A. Salzman, Feb., 275

Time-dose relationship in Hodgkin's disease, Ralph M. Scott, Feb., 276

Tissue isodoses curves for beta surface applicators, Wesley G. McTaggart, Walton D. West, Harry A. Claypool and Vincent P. Collins, Feb., 278

Visual search patterns in roentgen diagnosis, William J. Tuddenham and William P. Calvert, Feb., 255

**WORKMAN, JOSEPH B. See OTOMO, EIICHI**

**WRIGHT, D. J. See ASH, C. L.**

**WRIGHT, KENNETH A. See TRUMP, JOHN G.**

**WRIST**

—fractures

—fractures of triquetrum (ab), Lloyd K. Mark, Feb., 332

—tumors

—adamantinoma of capitate bone (ab), W. P. Diepeveen et al., April, 682

**WYLIE, EDWIN J. See PALUBINSKAS, A. J.**

**WYMAN, ALVIN C., and CIMMINO, CHRISTIAN V.:** Fluoroscopic examination of the urinary tract (ab), Feb., 333

**X-Y-Z**

**X-RAY THERAPY. See Roentgen Therapy**

**X-RAYS. See Roentgen Rays**

**XYLOCAINE. See Anesthesia, lidocaine**

**YAKOVLEV, PAUL I. See MELCHIOR, JOHANNES C.**

**YALOW, ROSALYN S., and BERSON, SOLOMON A.:** A radioisotope concentration gradient analyzer—design and application, Jan., 123

**YAMAMOTO, R. LUCAS. See LIPPINCOTT, STUART W.**

**YAMASAKI, MITSURU. See HEYSEL, ROBERT**

**YAMAZAKI, E., NOGUCHI, A., and SLINGERLAND, D. WARD:** Effect of methythiouracil and iodide on the iodinated constituents of thyroid tissue in Graves' disease (ab), April, 692

**YODER, VIRGIL E. See BAILY, NORMAN A.**

**YOHALEM, STEPHEN B. See ELLER, MILTON**

**YOUNG, W. B.:** Actinomycosis with involvement of the vertebral column: case report and review of the literature (ab), May, 852

**YTTRIUM. See Radioactivity, radioyttrium**

**YUE, W. Y. See TSAI, S. H.**

**ZAKRISSEN, ULF:** Meniscography by van de Berg's double contrast technique (ab), April, 683

**ZAROFF, LAWRENCE I. See ASHMAN, HYMAN**

**ZATUCHNI, JACOB. See STAUFFER, HERBERT M.**

**ZEID, SHERWIN S., FELSON, BENJAMIN, and SCHIFF, LEON:** Percutaneous splenoportal venography, with additional comments on transhepatic venography (ab), April, 673

**ZEIT, PAUL R., HUGHES, C. ROBERT, CAHILL, JOHN J., and HAMILTON, J. GREGORY:** Hypogastric arteriography prior to continuous infusion of malignant tumors of the uterine cervix and vagina. Preliminary report (ab), May, 846

**ZELLMER, ROBERT W. See ALLEN, RALPH G.**

**ZILIOOTTO, D.:** Hepatography and the study of the liver function by means of  $I^{131}$  tagged rose bengal (ab), March, 524

**ZIMMERMAN, CHARLES, and SAYEGH, VICTOR:** Roentgen manifestations of synovial osteochondromatosis (ab), Feb., 329

**ZINC. See Radioactivity, radiozinc**

**ZINICOLA, N. See MACARINI, N.**